THE PIANO CLOUD'S "COLOURS OF LIFE" CHALLENGE

DEEP OCEAN BLUE: THOUGHTS AND RESEARCH

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INTRODUCTION

For those that do not know me my name is Francis G. Loch a.k.a. Dreamland Fantasy on SoundCloud and other websites. I decided to take part in The Piano Cloud's *Colours of Life* challenge as I thought the project sounded fascinating and the idea that a number of musicians would each be creating their own composition based on their interpretation of a colour that would then be mixed into a symphonic rainbow of sound also intrigued me and was something that I knew that I wanted to be a part of.

Besides making music I have an interest in computer graphics and programming with a particular interest in image processing algorithms so the idea of doing something with colour and how I could translate that into a short musical composition also particularly appealed to me.
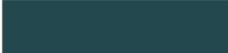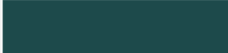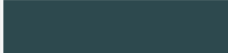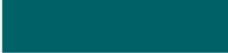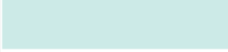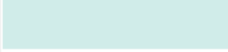
As part of this project I thought that I would share some of my thoughts and research hence why I have compiled this document! (^_^)

After being allocated the colour of deep ocean blue for this challenge my first step was to think about what this colour initially conjured up in my mind:

- Blue
- Hint of green
- Water
- Sea life
- Waves
- Depths of the oceans (dark/murky)
- Calmness/serenity

My next step was to find out exactly what deep ocean blue looked like so I had a quick look on the internet and found the following colour chart[1]:

Teal 2055-10	Tucson Teal 2056-10	River Blue 2057-10	Twilight 2058-10	Marine Blue 2059-10
Pacific Ocean Blue 205	Jade Garden 2056-20	Galapagos Turquoise 20	Slate Teal 2058-20	Caribbean Azure 2059-2
Caribbean Blue Water 2	Surf Blue 2056-30	Naples Blue 2057-30	Deep Ocean 2058-30	Laguna Blue 2059-30
Bahaman Sea Blue 2055-	Cool Aqua 2056-40	Ash Blue 2057-40	Cool Blue 2058-40	Yosemite Blue 2059-40
Fairy Tale Blue 2055-5	Baby Boy Blue 2056-50	Turquoise Powder 2057-	Aquarium Blue 2058-50	Pool Party 2059-50
Serenity 2055-60	Blue Seafoam 2056-60	Blue Flower 2057-60	Ocean Breeze 2058-60	Splash 2059-60
Innocence 2055-70	Icey Moon Drops 2056-7	Icy Blue 2057-70	Blue Angel 2058-70	Fountain Spout 2059-70

Given that the colour appears to be blue and green I thought it appropriate to convert the colour into an RGB (red, green and blue) value as used by most computer paint programs. By loading the above image into a suitable program and using the eyedropper tool the colour of deep ocean blue was found to have an RGB colour value of 18,107,127. Since the red component is arguably insignificant I chose to ignore it from further consideration.

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[1] http://www2.gloriousgaydays.com/uploaded_images/Benjamin-Moore-Deep-Ocean-725352.jpg

MEANINGS OF COLOUR

I had a look online for the meanings of colours. I found that there are a number of resources available online such as these pretty snazzy looking flashcards[2]:

Using the information from these flashcards plus a number of other resources[3] the following list, which is by no means exhaustive, was compiled from the information gathered:

BLUE		GREEN	
Intelligence	Police	Symbolic of nature	Bad luck
Communication	Royalty	Environmental awareness	Jealousy
Efficiency	Hanukkah	Harmony/balance	Boredom
Peaceful/tranquil	Boys	Peaceful/tranquil	Stagnation
Security	Magic	Universal love	Blandness
Orderly	Conservatism	Refreshing	Enervation
Loyalty/trust/duty	Liberalism	Rest/restoration	
Logic	Capitalism	Reassurance	
Coolness	Cold	Good luck	
Reflection	Lack of emotion	Conservative	
Technology	Unfriendliness	Masculine	
Cleanliness	Depressing	Implies wealth	
Ice	Spoilage/poison	Health	
Water	Sadness	Fertility	
Winter	Aloofness	Renewal	

Given that green and blue are so close to each other on the colour spectrum I suppose it should not be too surprising that there are some overlaps between the meanings of both colours.

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[2] http://www.webdesign.org/web-design-basics/color-theory/color-psychology-quick-reference-cards.13826.html
[3] http://en.wikipedia.org/wiki/Color;
http://www.colour-affects.co.uk/psychological-properties-of-colours;
http://psychology.about.com/od/sensationandperception/a/colorpsych.htm;
http://psychology.about.com/od/sensationandperception/a/color_blue.htm;
http://psychology.about.com/od/sensationandperception/a/color_green.htm;
http://nidafruity.blogspot.co.uk/2010/09/blog-post.html

Going through the list the attributes that I felt would be most appropriate for in my deep ocean blue contribution to the *Colours of Life* challenge was the following:

- Peaceful, tranquil etc. (green and blue)
- Coolness (blue)
- Water (blue)
- Sadness (blue)
- Symbolic of nature (green)
- Harmony, balance, etc. (green)
- Refreshing (green)

WORKING OUT THE COLOUR FREQUENCY FOR DEEP OCEAN BLUE

The following table[4] shows the wavelengths and frequencies of the colours green and blue:

COLOUR	WAVELENGTH (nm)	FREQUENCY (THz)
Green	~ 560-490	~ 540-610
Blue	~ 490-450	~ 610-670

I will work on the assumption that the frequency in the middle of the range is the pure colour (575 THz for green and 640 THz for blue).

Going back to the RGB value of the deep ocean blue colour the green component had a value of 107 and the blue component had a value of 127. Taking only the green and blue components into consideration the percentage of blue was calculated as follows:

$$\frac{127}{107 + 127} \times 100\% = 54.27\%$$

Taking our assumed range of pure green to pure blue as 575 THz to 640 THz taking a point that is 54.27% between these then the colour of deep ocean blue can be calculated to have a frequency of approximately 610.28 THz.

I started to wonder if I should take into account the human eye's perception of colour into the above equation as the human eye does not see each colour at the same level of intensity. This is illustrated in the images below[5] where the top image shows a selection of colours at their maximum intensity whilst the bottom image shows their perceived intensity level.

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[4] http://en.wikipedia.org/wiki/Color
[5] http://www.dfstudios.co.uk/articles/image-processing-algorithms-part-3/

To be honest I was not sure if this line of thinking was correct so I decided to test it by recalculating the equation using standard weightings for the green (0.587) and blue (0.114) colour components. The above equation thus became:

$$\frac{0.114 \times 127}{0.587 \times 107 + 0.114 \times 127} \times 100\% = 18.73\%$$

Following the same process as before the frequency was calculated to be 587.18 THz.

I wanted to compare the two frequencies with a colour spectrum chart so I converted[6] them into colour wavelengths:

COLOUR VALUES	WAVELENGTH (nm)	FREQUENCY (THz)
Unweighted	491.58	610.28
Weighted	510.92	587.18

By comparing the wavelengths on the colour spectrum[7] below it was clear that my approach using weighted colour values was not right as the colour at the wavelength of ~510 nm was too green. The approach with unweighted colour values giving a wavelength of ~490 nm gave a colour much closer to what was expected.
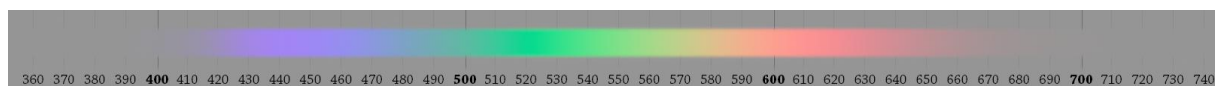
CONVERTING THE COLOUR TO A MUSICAL KEY

There have been a number of proposals[8] put forward in the past on how to assign colours to notes in the musical scale dating as far back as 1704. I felt however that I wanted to try devising my own method rather than copy someone else's.

One of the cool things about music is that to make a note go up an octave you double its frequency and conversely to make it go down an octave you half its frequency[9]. To translate the previously calculated frequency for deep ocean blue into a note on the musical scale I effectively kept halving 610.28 THz (610.28 x 10^{12} Hz) until I reached 555.04 Hz which is within the musical realm of frequencies. Looking up a chart[10] for the frequencies of notes on the musical scale the closest note was found to be C$^{\#}$/D^{b} at 554.37 Hz so this is the key that I will use for my composition.

THOUGHTS ON HOW THE COLOURS SHOULD SOUND

Okay, so I have worked out what key the composition should be in, but how should a deep ocean blue colour sound?

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[6] http://chemistry.about.com/od/workedchemistryproblems/a/Convert-Frequency-To-Wavelength-Worked-Example-Problem.htm
[7] http://en.wikipedia.org/wiki/File:Rendered_Spectrum.png
[8] http://rhythmiclight.com/archives/ideas/colorscales.html
[9] http://www.phy.mtu.edu/~suits/scales.html
[10] http://www.phy.mtu.edu/~suits/notefreqs.html

For the blue aspects of the colour the composition should have a feeling of water, particularly the murky depths of the ocean. For this I was thinking of using a lot of reverb and a low pass filter to "muddy" the sound a bit to try and achieve a wet and murky texture. Some slow arpeggios and maybe tremolo effects could perhaps provide a feeling of movement and fluctuations in the water. I also want to try and incorporate some feeling of sadness.

For the green aspects I want to include some sounds of nature like the waves, bubbles and perhaps even some whale song.

Both the green and blue aspects have the peaceful/tranquil attribute so the composition should have a slow and gentle pace to reflect this.

CHOOSING THE INSTRUMENTS

Since the composition is being written as part of a challenge set by The Piano Cloud I felt it was only right to have a piano included as an instrument.

To represent the colour of blue I think an instrument with a lower sound range would be suitable, perhaps something like a double bass.

To represent green something more mid-range like a violin or cello might be suitable. A mid-range instrument could also lend itself to the idea of green's balance attribute and could sit sonically between the instrument representing blue and the higher ranges of the piano. After some experimentation I decided to ditch the idea of using a violin or cello and ended up using a jazz guitar instrument instead which worked quite nicely to give the effect of the bubbles.

SUMMARY

For my allocated colour of deep ocean blue I set out to create a simple short 30 second composition that was serene, had aspects of water and the ocean (waves, bubbles, whale song, etc.), some sadness and also a bit of darkness. Probably the most difficult part for me was to limit the piece to 30 seconds as there were so many other things I felt I wanted to do to expand on it, but I'm happy with what I've achieved. (^_^)