COLOUR BLIND AWARENESS

Advice for
those caring for

non-verbal children

with a colour vision deficiency
(colour blindness)

Contents

Introduction

In the UK alone there are almost 3 million people colour blind people. The condition affects
- **1 in 12 (8%) males and 1 in 200 (0.5%) females**
- **approximately 400,000 school children**
- **the ability to identify many different colours, not just reds and greens**

25% of colour blind people have a severe form, so around 100,000 school children are severely colour blind - the vast majority are boys.

Normal colour vision   **Severe red/green colour blindness**

Modern teaching methods heavily rely upon the use of colour to teach, highlight, warn and explain, but what if the colours we describe are not the same for the children we are teaching?

The purpose of this document is to provide teachers, parents and carers with hints and tips about how to identify and support the colour blind children in their care. For those working with children using AAC there is a special section under **Colour Blindness and Education**.

Why Does Colour Blindness Matter?

Consider how children are instructed in early years' settings. We ask children to pick up the red brick. We encourage their ability to sequence in advance of reading by asking them to form colourful patterns with beads or other visual materials. We use colour in our descriptions of virtually everything, from the big brown dog, to the pretty pink flower and the green door that marks the entrance to the loo. We ask them to fill in colouring sheets in specific colours and sing songs about the colours of the rainbow.

If children are not 'getting' a percentage of what we are saying, they are not learning to full capacity and this is a problem that can not only undermine their confidence at an extremely impressionable age but provide a faulty foundation for future learning – read the **Colour Blindness and Education** section for more information.

What Causes Colour Blindness?

Colour blindness or CVD (colour vision deficiency) is largely a genetic disorder associated with the X chromosome, hence it affects males more than females. As a genetic disorder it does not improve or deteriorate through normal life and currently it cannot be treated. The most up-to-date research suggests that it is caused by faulty photo-receptors in the retina.

For more detailed information refer to www.colourblindawareness.org

Types of Colour Vision Deficiency

There are 3 main types of genetic CVD conditions which can vary from mild to severe forms;
- Protanopia/protanomaly relates to a red deficiency,
- Deuteranopia/deuteranomaly relates to a green deficiency and
- Tritanopia/tritanomaly relates to a blue deficiency.

In all deficiencies, however mild or severe, accurate perception of more than just one or two colours is affected.

People with red or green deficiencies will see the world in a similar way to each other because red and green are very close together on the light spectrum. Most people think red/green colour blind people confuse just red and green. This is not the case at all - red/green colour blind people have problems with colours right across the spectrum, particularly reds, greens, oranges, browns and greys, blues, purples and pinks.

Although red/green colour blind people can see blue, blues and purples can be confused because of the red tones in purple. Someone with a red vision deficiency will find it difficult to distinguish dark colours and can readily confuse a deep red with black.

Red/green deficiencies are very common but blue deficiency and total colour blindness (where everything is seen in shades of grey) are extremely rare.

Normal colour vision

A form of severe red/green CVD (Deuteranopia)

Tritanopia (severe loss of blue vision)

Colour blindness can sometimes be acquired as a result of other conditions such as diabetes and multiple sclerosis.

Children with other visual impairments e.g. glaucoma and retinitis pigmentosa, are also more likely to have colour vision defects which may not present in the same way as genetic red/green colour blindness – i.e. different colours may be affected.

Some medications are known to produce colour vision deficiencies too.

Diagnosis

Although colour vision screening in schools has largely been phased out nowadays, all opticians can test for the 2 main types of CVD although not all have the additional test system that covers all deficiencies. Colour deficiency testing is not a statutory part of the NHS eye examination in the UK but is something normally offered free by opticians, provided the test is requested. So even if a child has had an eye test with an optician there is only about a 20% chance that their colour vision will have been tested too.

The standard test is the Ishihara Plate test where numbers formed from coloured dots are set within a circle formed from dots of a different colour. Depending upon which numbers can be seen the optician can advise whether someone is colour blind or not.

What if the child in your care is unable tell you which numbers they can see? A special test is being constructed at the moment which will use eye gaze to determine responses, but this will not be available for some time. A genetic screening test is also under development which may be available in the UK shortly. In the meantime follow our tips on how to spot possible signs of colour blindness in the sections 'How to Identify a Young Child With CVD' and 'How to Identify CVD in a Non-Verbal Child'.

Colour Blindness and Education

This section is aimed specifically at teachers, parents and carers who may have a colour blind child in their care. It covers the following

- a general overview of the main issues
- information to enable teachers to understand where colour blind students might have difficulties
- hints and tips in how to identify and support a colour blind child at different stages in their school career. See **Nursery/ Pre-School/Key Stage 1** and **Key Stage 2 Onwards**
- Special Needs including those using **Alternative and Augmentative Communication**

Overview

Firstly, some information regarding colour blind children at school that you may not be aware of:-

- Colour blindness is not considered to be a Special Educational Need despite placing children at a serious disadvantage in most elements of their education so there is little or no provision to help children who simply cannot operate effectively using colour. On the whole teachers have had no training in how to identify and support colour blind children.

- While colour-blind children can learn to identify some colours through their hue and saturation – and experience – they cannot actually see most of them so colour-blindness will affect performance and understanding in many subjects.

- Many children feel embarrassed about not being able to choose the appropriate crayon or colour of paint, or to accurately describe things around them. They may be slower to follow instructions, because those relating to colour may make very little sense. Indeed, they may seem 'slow' or 'hesitant' in many situations, because they can and will be perplexed by the need to make choices based on something they simply cannot see.

- When colour-blind students are faced with a variety of different options based on colour, they will not only struggle to distinguish between them, but they will make basic errors that will compromise their work –and their ability to learn. When they are taught using colour, they will spend precious time trying to work out what is being explained or highlighted and fail to absorb the information either efficiently or correctly.

- Books highlighting 'familiar' key words and sounds are largely useless to colour-blind children, as are those that use colour-on-colour printing, which is almost impossible for many colour-blind children to read.

- In secondary school students are encouraged to colour maps and graphs; colour is used to highlight material and as keys in instructions; it is used in the science lab, the art room, in maths, food technology, ICT and history; teachers use it on whiteboards and often use different colours for marking.

For the average student, colour is a useful tool. For colour-blind students, who do not see many of the colours in question, it can be a nightmare – undermining confidence, encouraging basic errors and causing frustration and even anger.

Some children may have a mild form of CVD whilst for others (25%) their condition will be severe. It is not possible to find out exactly which colours someone with a less severe condition will be able to see, therefore best practice is to assume (i) you will have at least one CVD child in each class and (ii) all CVD children have a severe form of colour blindness.

What Can Teachers Do?

Nursery/ Pre-School/Key Stage 1

First of all, consider screening children as they enter your centre. A local optician may be able to arrange this, as can the visual impairment team in your local authority. Alternatively, visit www.colourblindawareness.org for more information. Knowing which children are colour-blind (and chances are that there will be at least one in every year group), can help you to make appropriate provision for their education.

- Think about the lighting in your classroom. Good lighting can make it easier for children to recognise colour. Colour-blind children should be seated in good natural light, but avoid bright sunlight and artificial light as these can distort a CVD child's perception of colour

- Take time to group and label things like coloured pencils, paints, beads, bricks and colouring material according to colour. Think about how you colour-code boxes of toys, art materials and books. Little ones will obviously find it difficult to read labels using words, but you could find a creative alternative. For example, the red beads could be labelled with a photograph of a fire engine; the green ones with leaves.

- Most young children learn the colours of things, even if they do not know what they are, and can confidently tell you that the grass is green, even if they cannot see it. Therefore, giving them clues can help them to make the correct associations and learn to use and choose colours appropriately.

- Avoid using colour-on-colour books and other support materials. Black on white will be most appropriate for colour-blind children.

- In sports and games (including board games), ensure that children can see who is on his or her 'team', and that they can see the ball or the 'men' on the board.

- Checking computer settings, web pages and computer-based teaching aids to ensure that the child can pick out the relevant information. Colour-blind children may struggle with coloured 'keys' that provide instructions and information.

- Use strong contrast on white or chalkboards; red, green or pastel colours should not be used to highlight teaching points.

- Encourage children to help each other choose colours when drawing, painting or colouring, and to reinforce their use by using the correct name. Many colour-blind children will eventually memorise their colours through repeated experience of their use.

- If you are teaching reading, use symbols rather than 'colours' for different levels of books, or clearly explain to children which box is theirs.

- Talk to parents about how they can support their children at home, and direct them to the Colour Blind Awareness website www.colourblindawareness.org for help.

www.colourblindawareness.org

How to Identify a Young Child with CVD

Once a colour blind child realises that he finds colours more difficult to recognise than his peers, he will try to hide his condition. This makes a colour blind child difficult to spot in a group.

Look out for:-

- inappropriate use of colours when colouring in e.g. green faces, purple sky, pink elephant, brown Father Christmas, red dog etc

- a young child insisting upon naming a toy using an incorrect colour e.g. a green teddy bear might be named 'blue' or 'grey' bear

- reluctance to help sorting toys when tidying up if the boxes are colour coded boxes (for fear of making a mistake)

- disruptive behavior/unwillingness/inability to play board games, matching games, some memory games, beads, following patterns

- copying other children in colour situations e.g. Art/science, the child might borrow a colour from a friend routinely after the friend has used it, then copy exactly where that colour went

- food
    - refusal to eat some foods (i) because they look particularly unappealing e.g. green vegetables appear brown; or (ii) because the child has made a mistake previously e.g. eaten a green banana

    - taking overly long to choose some foods – most crisp packets appear to be the same colour so (red) ready salted and (green) salt and vinegar are easily confused

    - other common food mix ups: ketchup/ brown sauce/vinegar sachets; chocolate/strawberry sauces, especially if the child can't read

If a child is demonstrating several of these signs consider whether he/she might be colour blind and ask the parents to have the child tested by an optician as soon as possible.

Key Stage 2 onwards

Older children will be less likely to make mistakes in choosing colours for themselves as they have had more time to learn the very subtle differences in shading which help them to identify different colours. They will also have had more time to hone coping techniques such as copying other children in colour situations. However, the older the child becomes the more they will be exposed to situations where they will be expected to interpret colour accurately, especially in school.

Try to remember that whilst colour is very important to people with normal colour vision, to colour blind people it is of little consequence.

Look out for:-

- computer/games console/TV being left on because the indicator light can't be seen

- inability to interpret some sections of computer games/homework software programmes/websites

- holding back in sports and team games where team colours may confuse e.g. red team and green team

- holding back in peer group work

- uninspiring presentation, lacking in colour and formatting. especially in ICT

- reluctance to speak in discussions where colour is a main element (maps in Geography, colour propaganda in History, Art discussions, coloured pie/bar/line graphs in Maths and Science etc)

- inability to read litmus paper, universal indicator and colour changes in chemistry

- 'silly' mistakes in geography, science, maths, history etc which could be caused by poor colour choices used in textbooks

Where you suspect a student might have problems with colour ask the parents to refer to an optician for a formal diagnosis.

Follow the tips for younger children but also try to:-

- 'Audit' your classroom, including computer-based interactive white board software packages, to ensure important messages for the students are not given in 'difficult colours', especially red and green

- Try to ensure all pencils, crayons, paints, felt-tipped pens and so on are all labelled with the name of their colour – you can buy ready-made stickers form specialist suppliers or visit www.colourblindawareness.org

- Use strong contrast on the board and on computer screens. Try not to use red, green, orange or pastel colours to highlight different teaching points; rather underline the words you wish to emphasise.

- Assign a classmate to help the student where coloured diagrams or pictures are being used.

- Consult with diagnosed colour blind students to identify where they might have problems and encourage them to let you know whenever they think problems with colour might occur

- Check worksheets for colour issues and where possible use patterns or secondary indicators e.g. labels, patterns and shading to differentiate rather than, or in addition to, colour. Photocopy worksheets into black and white if this is not possible.

- Avoid using a 'traffic light' system for the student to indicate how well he has understood a task - most colour blind people can't be relied upon to know the difference between red, green and orange

- In games/PE check the student is able to identify his teammates and if necessary use blue and yellow bibs to distinguish between teams (red/green colour blind people can see blue and yellow). Remember to check whether coloured training cones can be seen against grass, that the pupil can actually see the ball (e.g. red cricket balls and orange hockey balls are difficult to see against grass, particularly in poor light) and so on

- In art organize a colour palette for the student to memorise colour placement and focus on mediums other than colour e.g. charcoal, textiles, clay

- Be aware that at present textbook manufacturers do not take account of the needs of colour blind children.

For diagnosed CVD students ensure your SENCO and all teaching colleagues are aware of potential problems and ensure an Individual Education Plan is put in place for the student at the earliest opportunity.

What If *You* Are a Colour Blind Teacher?

Note that you may not always be aware of the strategies you use to cope with your own condition – these will probably be different to the strategies adopted by a colour blind student. Sometimes you may not be able to notice information which will be readily apparent to your colour normal students. You may have a mild condition or a different type of condition to your colour blind pupil and so will not necessarily be able to appreciate the needs of your colour blind students as they may not match your own. If you have any doubts always seek confirmation from colour normal peers/pupils and your colour blind students before using colour to make a teaching point.

Refer to www.colourblindawareness.org for further information.

Special Educational Needs

Colour vision deficiencies are likely to affect the results of any tests to indicate other Special Educational Needs which include colours as part of the assessment.

An example is the Rapid Colour Naming subtest of the CTOPP (Comprehensive Test of Phonological Processing) test which is used to indicate phonological processing and help identify dyslexia. Likewise the online Dyslexia Screener has a coloured shapes section which may also cause problems. Before using any such screening tests check them for potential colour issues and refer to the producers if you are unsure.

Be aware that even though a software package might have been put together by a specialist in Special Educational Needs this does not necessarily mean the software takes account of colour vision issues because at present CVD is not considered to be a SEN.

As mentioned in the **Types of Colour Vision Deficiency** section, children with some other visual impairments such as glaucoma and retinitis pigmentosa, are also more likely to have colour vision defects which may not present in the same way as genetic red/green colour blindness – i.e. different colours may be affected.

Without a Visual Impairment Statement it will be difficult or impossible to get access to Visual Impairment services for a child with CVD. Hence if you suspect a child is showing signs of possible CVD it is extremely important to arrange for a child to be tested and diagnosed with a Statement to ensure you can fully access support.

Children with colour vision problems who also have other special educational needs are far more vulnerable than CVD children in mainstream school environments not only because they may not be able to verbalise their inability to distinguish some colours but also because colour is an inherent part of educational tools for early years teaching and for children with special needs.

Therefore it is extremely important for teachers and carers to be able to identify whether or not a non-verbal child might have colour vision problems so that they can specifically tailor teaching aids to the needs of the individual child.

Alternative and Augmentative Communication (AAC)

There is some evidence to suggest a higher prevalence of CVD in those with cerebral palsy than in the rest of the population, not only because of complications arising from other visual impairments, but also due to increased defects in genetic code. Further research is in progress in the U.S. to understand the statistics and factors underlying this.

Where colour vision deficiencies are present in a non-verbal child which have been acquired from other causes e.g. retinitis pigmentosa, the colours a child has problems with may be different to those which cause problems for someone with genetic CVD (common red/green colour blindness).

At present it is not possible to simulate or fully appreciate what such a child might be able to see, so the only way to understand is to try the *Colour Blind Awareness Indicative Test for CVD in Non Verbal Children cards,* work out the potential problems colours for each individual child and avoid those colours when teaching that child in the future. Cases of acquired CVD are relatively rare in children – around 5% of cases of CVD – and the following advice therefore refers to genetic red/green colour blindness only.

How to Identify CVD in a Non-Verbal Child

As mentioned earlier, although under development, at present there are no formal tests available in the UK to diagnose CVD in non-verbal children. Contact the Colour Blind Awareness Organisation at info@colourblindawareness.org for further details of indicative tests using eye gaze or activities for children using hand-grabbing techniques which can help to identify colour vision deficiencies in non-verbal children.

Also contact Colour Blind Awareness if you would like to arrange for a representative to visit and undertake indicative testing at your centre and/or provide training for your staff.

A child will not be suitable for indicative testing for CVD unless they are able to indicate differentiation between 'same' and 'different'.

If You Suspect CVD in a Non- Verbal Child, What Next?

Update the child's communication passport - note possible problem colours and ensure the symbol book is colour blind compliant too. In future try to avoid all combinations of colours the child has found it difficult to tell apart in the test. Remember to include colour blindness as part of the Early Years Moving Up booklet.

Consider all the methods you are using to communicate with the child including communication books, encoding, keyboards, and software packages. **Be aware that even though a software package might have been put together by a specialist in cerebral palsy this does not necessarily mean the software takes account of colour vision issues.**

Communication Boards and Books

If you suspect a child might be colour blind select a white background for symbols and try to avoid colour coding unless you have clearly established that the child can 'see' the specific colours you have chosen for colour coding different subjects. Read the 'Software' section below for more information.

Encoding

As colour matching is a vital element of Encoding, make sure you no longer use colours which could potentially cause problems.

In the image below red and green will probably cause confusion so, to be on the safe side, replace one of these with a safer colour choice – this is quite difficult as reds, browns, greens, oranges and even black can cause confusion. Purple could be confused with blue, so the best option would be to use red OR green, yellow, dark blue and light blue.
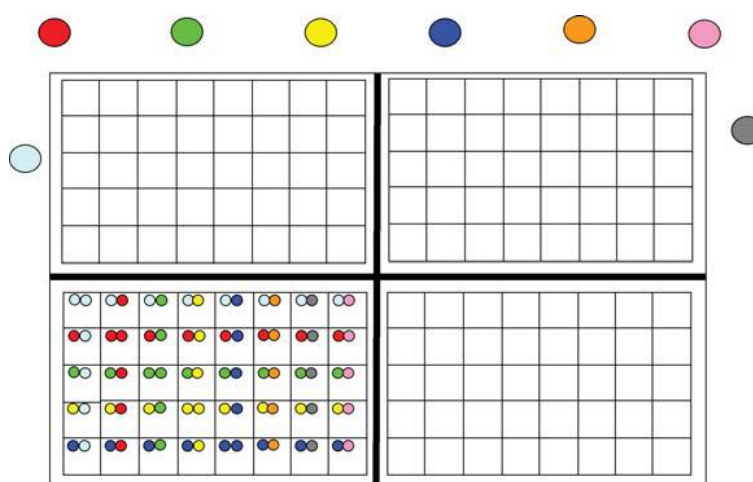
Source www.scope.org.uk

If the child is too young to understand the concept of dark blue and light blue then use 'lilac' instead of the dark blue so it can be recognised as a separate colour. A child with CVD wil 'see' light blue and lilac as the same colour so note that the child may confuse lilac with light blue as they develop the ability to understand the concept of dark and light colours.

If possible consider using different shapes for symbols/corner 'squares' instead of colour.

Co-ordinate encoding using colours will probably not work for a child with a colour vision deficiency because of the range of colours needed to make up the co-ordinates.

Source www.scope.org.uk

In the example above red, green and orange could appear to be the same colour, likewise pink and grey could appear to be the same colour.

However, you could consider using symbols or numbers instead of colours.

Keyboards/on-screen keyboards

Think carefully before colour coding keyboards. With younger CVD children avoid using different colours for different lines on the keyboard or to colour in vowels. Again, consider using symbols or shapes instead of colours.

If you are using an on-screen keyboard avoid background colours where possible and check carefully for good contrast between the text and background chosen. If in doubt ask the child if they can easily see the text.
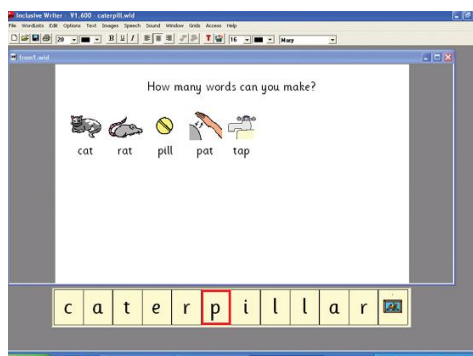
Software for Pre-school children / Symbol-based software for constructing charts, books etc

In order to demonstrate some of the problems which can arise from specialist software a few examples of slides are included below with comments on the chosen colours.

Initial letter to picture matching

As programmes which require the user to match initial letters to pictures appear in almost all software catalogues, be aware of potential pitfalls such as the one illustrated below where a child with a severe red vision deficiency may not be able to make out the red box around the 'p'.
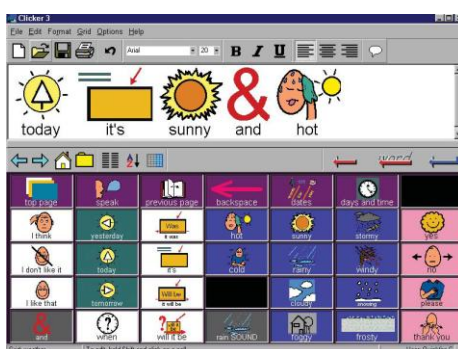
> *Tip: check with the child that they can see the outline of the box and if necessary either use blue to outline the selected box or make the outline of the box much thicker.*

Source www.scope.org.uk

Whole word approaches

This image from a *Clicker* programme below illustrates several potential issues for a colour blind user.
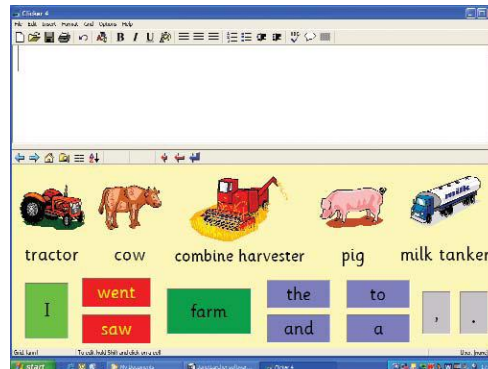

Source www.scope.org.uk

Firstly, it demonstrates how much easier it is to read the symbols against a white background (whether you are colour blind or not) and secondly that small images and text are difficult to read against dark backgrounds.

Although the actual sentence constructed by using the symbols 'today it is sunny and hot' can be clearly read because of the strong contract between the symbols and the white background, particular issues with this slide are

- For red deficients, red on grey will be difficult or impossible to see (**&** symbol) as will the red arrow on the purple background (backspace symbol).

- The background shade of green chosen (e.g. TODAY) will appear to be similar to or the same as the background grey (RAIN)

- The blue background (weather symbols) appears to be very similar to or the same as the purple background (previous page etc symbols)

   Tip: Change the red arrow to a white arrow, choose a lighter shade of blue and a yellower shade of green
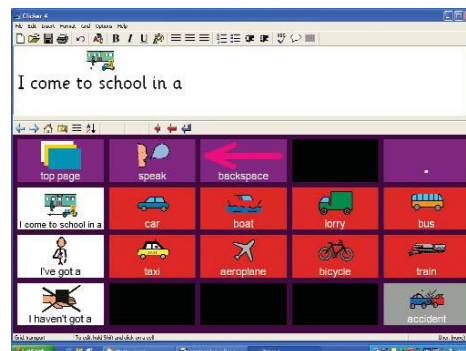
In the next slide (I went to a farm…) below

Source:www.scope.org.uk

- Red and dark green will be confused so 'noun' and 'verb' backgrounds may appear the same, although the yellow text on red can be used to distinguish between noun and verb.

- Black text on dark green will be very difficult to read, but the black text on the lighter green will be legible.

   Tip: use a strong yellow background in place of the darker green

In the 'I come to school in a ….' Slide below

Source:www.scope.org.uk

- As before the red arrow on the purple background will be very difficult to distinguish

- The lorry symbol is very difficult to see (green on red) as are the wheels of the bicycle.

- A red deficient will be unsure as to whether there is any information on the blank (black) rectangle as he will be used to not being able to see red text on black and vice versa

Tip: make the red a paler shade and show the blank boxes as white

To give a better indication of how people with different deficiencies see colours differently a 'normal vision' image of coloured pencils has been altered to simulate severe loss of green vision (left) and severe loss of red vision (right).

Note that although some colours are seen to be the same in both conditions, there are colours which look different – so if you have green loss you could tell a difference between green and orange but if you have a red loss you can't.

Total green loss   **Normal colour vision**   **Total red loss**

www.colourblindawareness.org

Where to find resources

Visit the www.colourblindawareness.org for

- colouring pencils marked with the name of their colour
- stickers printed with the names of colours for paint pots, crayons, storage boxes etc for both home and classroom use
- indicative CVD testing kit for non-verbal children
- to arrange visits for staff training/indicative testing of students

How to obtain further help

Refer the child to the Specialist Teaching Services/Visual Impairment team at your Local Education Authority who should be able to advise you about how to support the child's specific type of colour vision deficiency.

Want to know more?

Refer to the Colour Blind Awareness Organisation's website www.colourblindawareness.org for more detailed information including how to support CVD children at home. You will find a huge range of visual images to clearly demonstrate the issues faced by CVD sufferers together with tips to manage things day to day.

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