Monk skin tone analysis

for Josh and Sandhya's melanometry project

WCC, 12/14/2022

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Monk RGB data retrived from https://skintone.google/get-started

```
rgb_monk = zeros(10,3);
rgb_monk(1,:) = rgb(246, 237, 228);
rgb_monk(2,:) = rgb(243, 231, 219);
rgb_monk(3,:) = rgb(247, 234, 208);
rgb_monk(4,:) = rgb(234, 218, 186);
rgb_monk(5,:) = rgb(215, 189, 150);
rgb_monk(6,:) = rgb(160, 126, 86);
rgb_monk(7,:) = rgb(130, 92, 67);
rgb_monk(8,:) = rgb(96, 65, 52);
rgb_monk(9,:) = rgb(58, 49, 42);
rgb_monk(10,:) = rgb(41, 36, 32);

lab_monk = rgb2lab(rgb_monk/255);

ita_monk = rad2deg(atan((lab_monk(:,1) - 50) ./ lab_monk(:,3)));
```

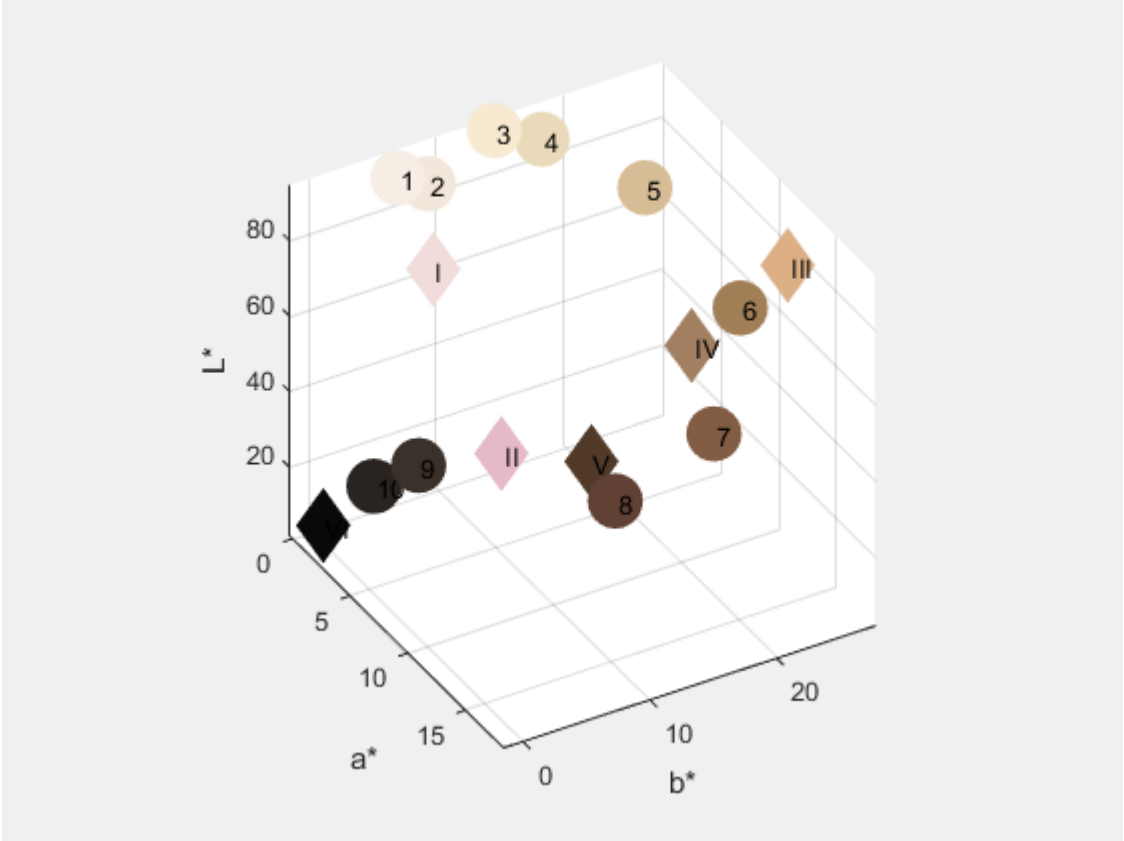
Fitzpatrick RGB data retrived from screenshot of https://www.ncbi.nlm.nih.gov/books/NBK481857/table/chapter6.t1

```
%
% Fitzpatrick
%
rgb_fitzpatrick = zeros(6,3);
rgb_fitzpatrick(1,:) = [241 220 219];
rgb_fitzpatrick(2,:) = [229 185 200];
rgb_fitzpatrick(3,:) = [220 175 133];
rgb_fitzpatrick(4,:) = [162 127 97];
rgb_fitzpatrick(5,:) = [81 58 40];
rgb_fitzpatrick(6,:) = [10 9 7];

lab_fitzpatrick = rgb2lab(rgb_fitzpatrick/255);
```

```
ita_fitzpatrick = rad2deg(atan((lab_fitzpatrick(:,1) - 50) ./ lab_fitzpatrick(:,3)));
marker_fitzpatrick = {"I", "II", "III", "IV", "V", "VI"};
```

3D View

```
dist = 0.1;         % where to put labels

clf
hg = gcf;
set(gcf,'Visible','on')
hold on

% change 1 to 0 to skip Monk
if 1
    for i=1:10
        plot3(lab_monk(i,2),lab_monk(i,3),lab_monk(i,1),'o','MarkerSize',20,'MarkerFaceColor',r
        text(lab_monk(i,2)+dist,lab_monk(i,3)+dist,lab_monk(i,1),sprintf('%d',i))
    end
end

% change 1 to 0 to skip Fitzpatrick
if 1
    for i=1:6
        plot3(lab_fitzpatrick(i,2),lab_fitzpatrick(i,3),lab_fitzpatrick(i,1),'d','MarkerSize',2
        text(lab_fitzpatrick(i,2)+dist,lab_fitzpatrick(i,3)+dist,lab_fitzpatrick(i,1),marker_fi
    end
end

xlabel('a*')
ylabel('b*')
zlabel('L*')
grid on
view(60,35)

% make GIF
create_animation ('skin_color_in_CIELAB.gif')
```



Show ITA on L*b* to answer Josh's question

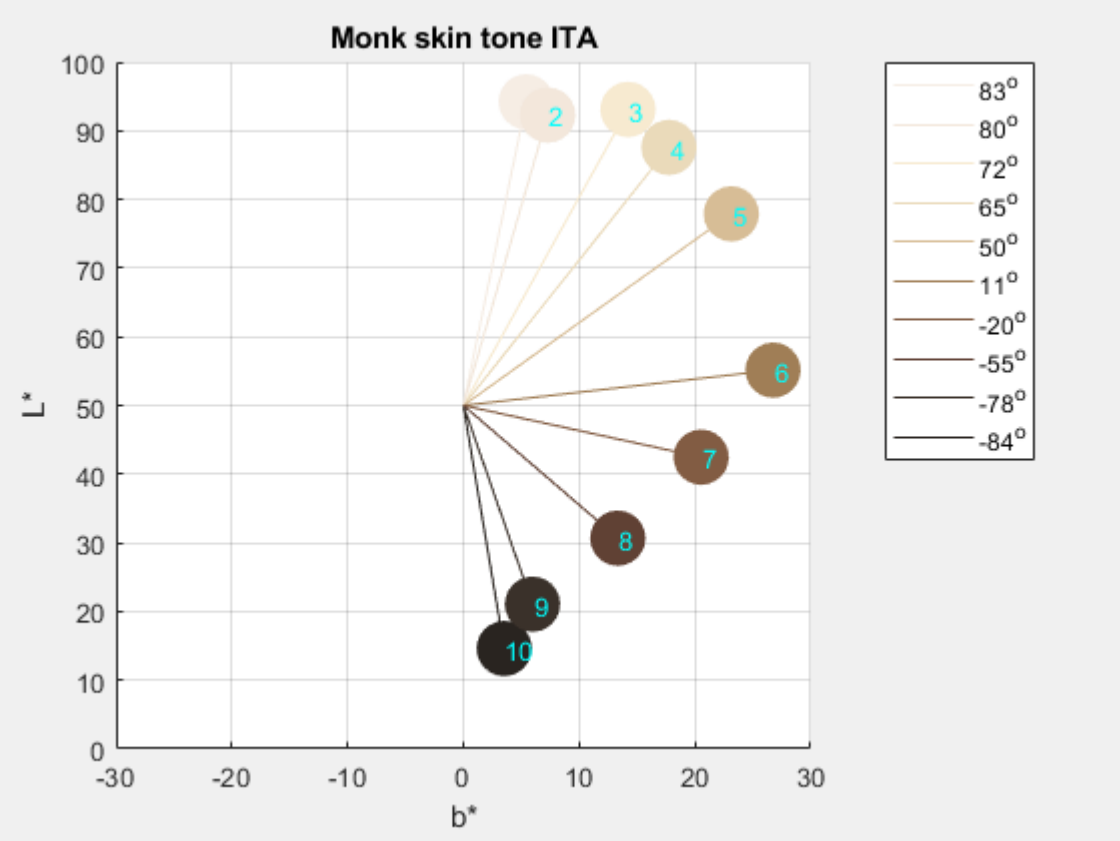
```
lab_monk
```

```
lab_monk = 10×3
   94.2111    1.5039    5.4302
   92.2748    2.0617    7.2881
   93.0911    0.2173   14.2122
   87.5733    0.4608   17.7549
   77.9022    3.4729   23.1415
   55.1428    7.7854   26.7444
   42.4700   12.3267   20.5334
   30.6783   11.6686   13.3380
   21.0695    2.6910    5.9667
   14.6102    1.4828    3.5276
```

```
ita_monk
```

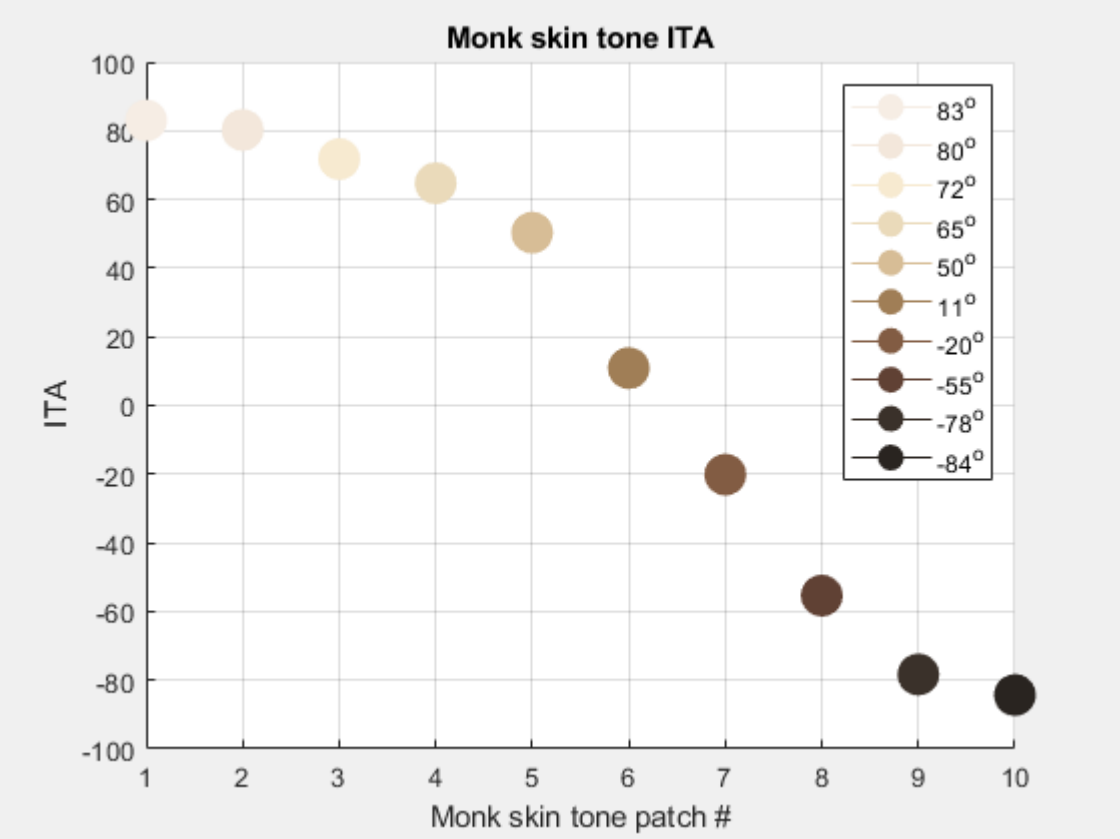
```
ita_monk = 10×1
   82.9977
   80.2184
   71.7465
   64.7073
   50.3284
   10.8849
  -20.1390
  -55.3822
  -78.3465
  -84.3077
```

```
clf
hg = gcf;
set(gcf,'Visible','on')
hold on

% for i=1:10
% end

center = [0 0 50];

for i=1:10
    plot3(lab_monk(i,2),lab_monk(i,3),lab_monk(i,1),'o','MarkerSize',20,'MarkerFaceColor',rgb_m
    text(lab_monk(i,2)+dist,lab_monk(i,3)+dist,lab_monk(i,1),sprintf('%d',i),'Color','c')

    lgn{(i-1)*2+1} = '';
    lgn{(i-1)*2+2} = sprintf('%.0f^o',ita_monk(i));

    p_from = center;
    p_to = [lab_monk(i,2) lab_monk(i,3) lab_monk(i,1)];
    p_from_to = [p_from; p_to];
    plot3(p_from_to(:,1),p_from_to(:,2),p_from_to(:,3),'-','Color',rgb_monk(i,:)/255)
end


axis([-30 30 -30 30 0 100])
xlabel('a*')
ylabel('b*')
zlabel('L*')
grid on
view([1 0 0])
title('Monk skin tone ITA')
legend(lgn)

saveas(hg,'monk_ita_on_Lb_plane.png')
```



Show ITA trend to answer Josh's question

```
clf
hold on
lgn = {};
for i = 1:10
    plot(i,ita_monk(i),'o-', ...
        'MarkerFaceColor',rgb_monk(i,:)/255, ...
        'MarkerEdgeColor',rgb_monk(i,:)/255, ...
        'Color',rgb_monk(i,:)/255, ...
        'MarkerSize',15)
    lgn{i} = sprintf('%.0f^o',ita_monk(i));
end
grid on
legend(lgn)
xlabel('Monk skin tone patch #')
ylabel('ITA')
title('Monk skin tone ITA')

saveas(hg,'monk_ita_on_a_curve.png')
```



Show Fitzpatrick ITA

```
lab_fitzpatrick
```

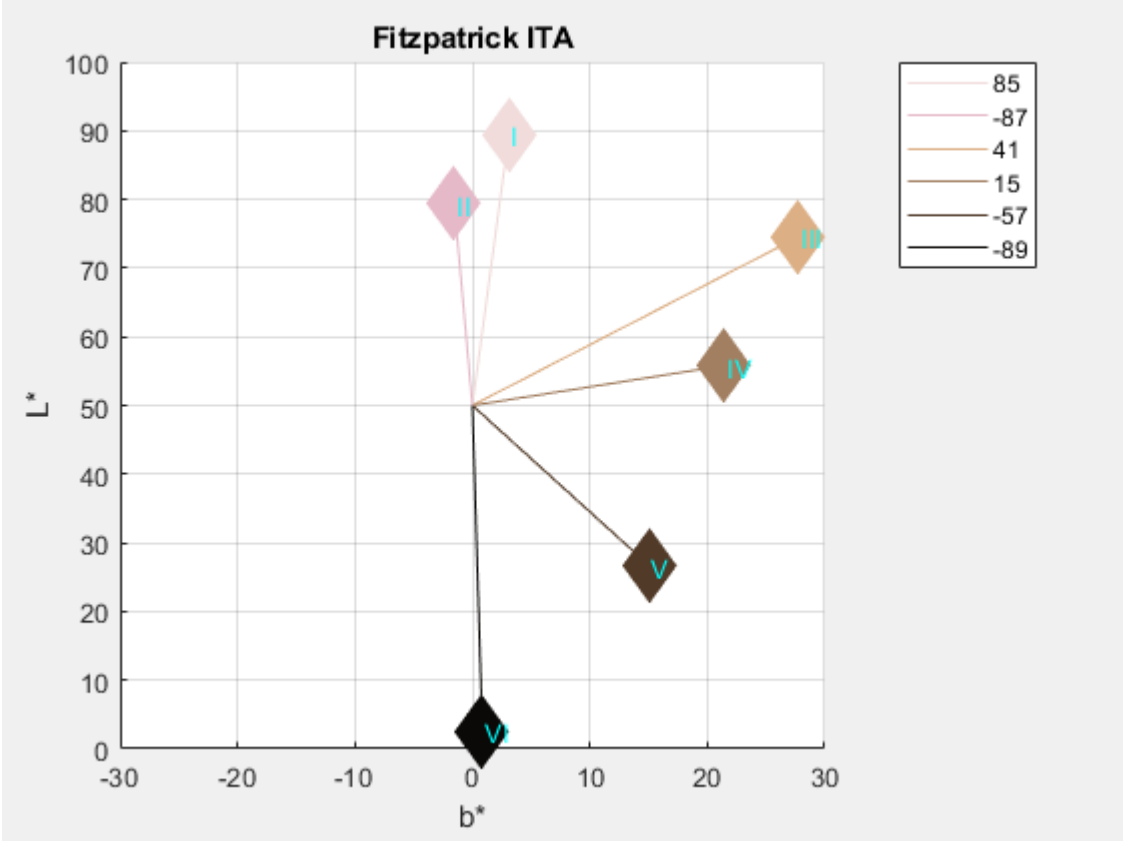
```
lab_fitzpatrick = 6×3
   89.3943    7.0401    3.1064
   79.3444   18.1579   -1.5484
   74.5539   10.8187   27.7700
   55.8109    9.3193   21.4728
   26.5315    7.5715   15.1537
    2.4863   -0.0166    0.8491
```

```
ita_fitzpatrick
```

```
ita_fitzpatrick = 6×1
   85.4914
  -86.9795
   41.4827
   15.1425
  -57.1495
  -88.9763
```

```
clf
hg = gcf;
set(gcf,'Visible','on')
hold on

% for i=1:10
```

```
%     plot3(lab_monk(i,2),lab_monk(i,3),lab_monk(i,1),'o','MarkerSize',20,'MarkerFaceColor',rgb
%     text(lab_monk(i,2)+dist,lab_monk(i,3)+dist,lab_monk(i,1),sprintf('%d',i))
% end

center = [0 0 50];

for i=1:6
    plot3(lab_fitzpatrick(i,2),lab_fitzpatrick(i,3),lab_fitzpatrick(i,1),'d','MarkerSize',20,'M
    text(lab_fitzpatrick(i,2)+dist,lab_fitzpatrick(i,3)+dist,lab_fitzpatrick(i,1),marker_fitzpa
        'Color','c')

    lgn{(i-1)*2+1} = '';
    lgn{(i-1)*2+2} = sprintf('%.0f',ita_fitzpatrick(i));

    p_from = center;
    p_to = [lab_fitzpatrick(i,2) lab_fitzpatrick(i,3) lab_fitzpatrick(i,1)];
    p_from_to = [p_from; p_to];
    plot3(p_from_to(:,1),p_from_to(:,2),p_from_to(:,3),'-','Color',rgb_fitzpatrick(i,:)/255)
end


axis([-30 30 -30 30 0 100])
xlabel('a*')
ylabel('b*')
zlabel('L*')
grid on
view([1 0 0])
title('Fitzpatrick ITA')
legend(lgn)
```



Convert the string copied from Google website

```
function val = rgb (r,g,b)
val = [r g b];
end
```