Monash University: Assessment Cover Sheet

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School/Campus	Clayton		**Student's I.D. number**	31389171
Unit name	FIT3179 Data visualisation - S2 2023			
Lecturer's name	Bernhard Jenny		**Tutor's name**	Clair Pan
Assignment name	Data Visualisation I Report		**Group Assignment: No**	
			Note, each student must attach a coversheet	

Lab/Tute Class: Studio 17	**Lab/Tute Time:** Thu 3PM	**Word Count:** 970
Due date: 03-09-2023	**Submit Date:** 3/9/2023	**Extension granted** ☐

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Extension granted until (date): ..../......./........... Signature of lecturer/tutor: ....

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MONASH UNIVERSITY
FACULTY OF INFORMATION TECHNOLOGY

Australian Earnings and Working-Related Injuries
FIT3179 Data Visualization 1 Report

Minhua Zhou
31389171

DATE: 3RD SEPTEMBER 2023

URL:

TUTOR: CLAIR PAN

CE/LECTURER: ASSOCIATE PROF. BERNHARD JENNY

Content

Domain

The visualization is created based on the topic of Australian earnings and work-related injuries. This topic is chosen based on some real-life scenarios in which more people are doing a second job such as Uber driver to support their families and daily expenses due to negative economic impacts caused by the pandemic. Extra jobs also bring extra risks and potential injuries therefore the topic of working-related injuries is also introduced in the visualization. The target audience for such visualization can be employees, employers and government financial institutions as they should understand what factors may lead to different income levels and why OHS matters.

What

The data used in this visualization is from the Australian Bureau of Statistics. The earnings data is collected via a survey given to Australian business owners. (*Employee Earnings and Hours, Australia*, 2021) The working-related injuries data is collected via interviews with participants selected from the Multi-Purpose Household Survey responses. (*Work-related Injuries*, 2022) The data is divided into multiple datasets that have already been categorized by the ABS thus the data doesn't require much processing for visualization.

Why and How

Within this visualization shown in Figure 1,2 and 4, four idioms are used to make up the nine charts that form this dashboard.

The first idiom used is the radial bar chart. (*The Data School - Create a Radial Bar Chart in Tableau*, n.d.) It is intended to allow the audience to see the comparison between different categories (sex and employment status) on a polar coordinate system. The diagram can function the same way as a regular bar chart but also makes the chart more attractive.

The second idiom used is the dot plot. It is intended to allow the audience to see the difference in average weekly earnings between different sexes and industries/occupations.

The third idiom used is the butterfly chart. It is still similar to a bar chart. However, the key information sent by the butterfly chart is the difference in injury rates between 2017-18 based on injury types/causes and the ones in 2021-22. For earnings, the butterfly chart is intended to show the audience the comparison between working hours and hourly rates and also the difference between different industries/occupations.

The fourth idiom used is the packed bubble chart. It is intended to use the size of each bubble to show the audience the comparison of injury rates between different occupations/industries within specific sex groups.

Within this visualization, not much interactive feature is implemented except the filtering. So if the user selects one of the occupations/industries, the other charts should be changed accordingly.

Design

Layout

For this visualization, the layout is structured from top to bottom and considering the size of the actual dashboard, it has been divided into 2 columns and several rows. In order to ensure the visual balance, the 2 columns are configured to be the same size so it can be vertically symmetrical and it's intended to allow the audience to recognize most charts with equivalent importance. The row sizes are a bit different based on the needs of the idiom and the final appearance on the dashboard. The rows are structured based on the information sectors and storytelling hierarchy. Whitespaces are intentionally left between each section and the extra image as Figure 3 (National Careers Institute, 2023) is added to also ensure visual balance.

Colour

The colours used in this visualization are all employed from the colour blind palette where the colours are clearly distinct from each other and allow those with visual impairments to be able to recognize the difference between colours. Colours are used consistently across different sections. For instance, colours representing sex in the 2 butterfly earnings charts are the same. For the injury part, colours are the same if occupations/industries are ranked the same. Colours are also used in texts, such as industries/occupations that are treated not so fair are in red text and the ones that are fairly treated are in green text.

Figure-ground

Within this visualization, there are several elements that use the colour to represent certain meanings thus in order to demonstrate the information clearly, I have chosen to use the white background for the whole dashboard. Another typical example is the injury rate comparison between different sexes for industry/occupation, originally, different colours have been used for different industries or occupations. However, that makes the importance of showing injury rates not so obvious. Thus the use of colours has been changed to only show the top 3 and all others are shown in light grey colour to emphasize the top 3.

Typography

For this visualization, there are 2 non-default typefaces used. For the dashboard title or section titles, I have used one typeface to denote them so the audience knows they are going into a new section. Information that's conveyed via text, annotations or tooltips, is written in another typeface so that the audience understands this is more detailed information. Essential information is also highlighted with bold, italics or underlining. Text that denotes points like max value is also shown with larger size to allow the audience to notice such info more straightforwardly.

Storytelling

The storytelling of this visualization is done with all the elements mentioned above. It intends to allow the audience to understand the Australian average earning first and what factors constitute to the difference in income levels. One technique that I employed here is to sort each visualization based on certain fields in that visualization so that the audience can understand the max and min points and potentially average value with the assistance of the annotations. The sorting has also been applied to the last 2 butterfly charts where the audience focus should be firstly put on the most common injury types and causes and for potential future plans, try to eliminate such risks in the workplace as soon as possible. Texts are also added before each section for the audience's understanding.

References

1. National Careers Institute. (2023, February). *AJR_hero*. Your Career.

   https://content.yourcareer.gov.au/sites/default/files/2023-02/AJR_hero.jpg

2. *Employee Earnings and Hours, Australia*. (2021, May). Australian Bureau of

   Statistics.

   https://www.abs.gov.au/statistics/labour/earnings-and-working-conditions/empl

   oyee-earnings-and-hours-australia/latest-release

3. *Work-related injuries*. (2022). Australian Bureau of Statistics.

   https://www.abs.gov.au/statistics/labour/earnings-and-working-conditions/work

   -related-injuries/2021-22

4. *The Data School - Create a radial bar chart in tableau*. (n.d.).

   https://www.thedataschool.co.uk/jack-parry/create-a-radial-bar-chart-in-tablea

   u/

Screenshot

AUSTRALIAN EARNINGS & WORKING-RELATED INJURIES
How much goes into my pocket and how much risk am I taking?

AUSTRALIAN EARNINGS

In the Australian labor market, differences between average earnings can be attributed to several factors, including **occupational preferences**, **industry distributions**, and **potential systemic biases**. There is a notable discrepancy in earnings between **genders**, with males generally reporting higher average incomes compared to females.

Data analysis of average earnings with factors of occupations and industries reveals _**significant variations**_ in income levels. For instance, industries such as engineering or technology or mining tend to exhibit higher average incomes when contrasted with industries like retail or food services. Occupations such as managerial roles demonstrate higher average incomes than normal clerks.

Average Weekly Earnings by Sex & Employment Status

Full-time males make the **MOST** on average with approximately $1,934 per week.

Part-time males make the least on average with approximately $722 per week with limited working hours.
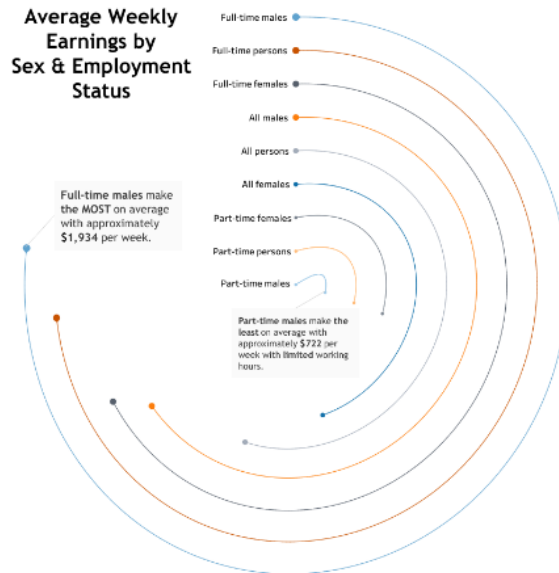
Average Weekly Earning by Sex & Occupation

Male Managers make the **MOST** on average with approximately $2,736 per week.

Female Labourers make the least on average with approximately $1,137 per week.

Among **All occupations**, most people make approximately $1,801 per week. Though after sorting, the average has obviously been scaled up due to earnings of managerial roles.

Average Weekly Earning by Sex & Industry

Males in Mining make the **MOST** on average with approximately $2,863 per week.

Females in Accommodation and food services make the least on average with approximately $1,179 per week.

Among **All Industries** most people make approximately $1,801 per week. Though the overall pattern shows males make more than females on average.
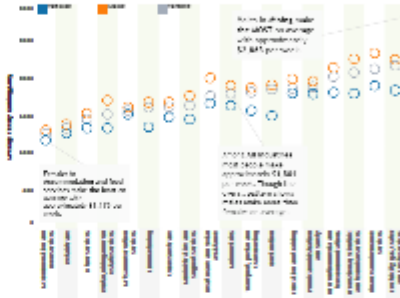
Average Hourly Rates VS Average Weekly Working Hours
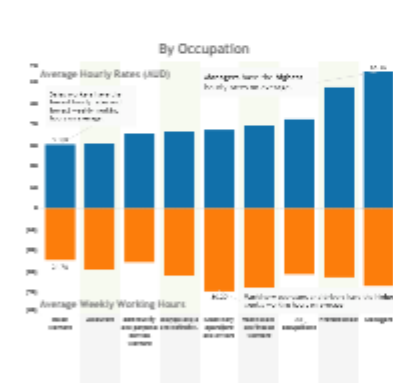
In occupational comparisons, managerial roles command **higher average hourly rates** but generally entail **shorter weekly working hours** compared to machinery operators and drivers. On the industry level, engineering and tech-related sectors offer **higher hourly rates** alongside **relatively longer working hours**, while construction or manufacturing industries feature similar high working hours but **comparatively lower hourly rates**.

By Occupation

Average Hourly Rates (AUD)

Sales workers have the lowest hourly rates and lowest weekly working hours on average.

Managers have the highest hourly rates on average.

Average Weekly Working Hours

Machinery operators and drivers have the highest weekly working hours on average.

By Industry

Average Hourly Rates (AUD)

Accommodation and food services industry has the lowest hourly rates and lowest weekly working hours on average.

Mining industry has the highest hourly rates and highest weekly working hours on average.
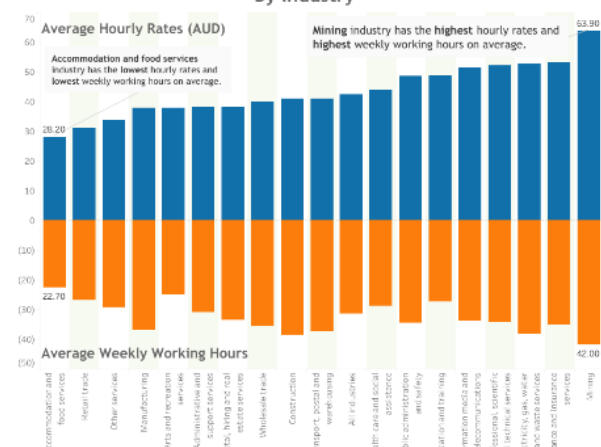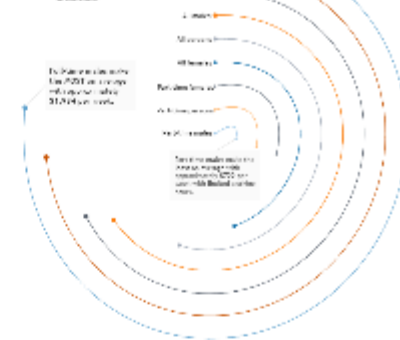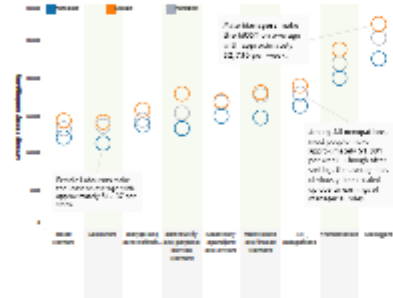
Average Weekly Working Hours

Figure 1. Dashboard upper part view

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WORKING RELATED INJURIES

The following 2 charts demonstrate the working related injury rates in relation to occupation and industry from 2021-2022 in Australia among all injuries reported. Industries and occupations ranked *TOP 3* based on injury rates are highlighted with unique colors.

The top three occupations with the highest injury rates for men were *technicians and trade workers*, followed by *other occupations* and *machinery operators and drivers*. Conversely, women reported the highest injury rates in *other occupations, community and personal service workers*, and *professional* positions.

In terms of industries, men experienced the highest injury rates in *other industries, construction*, and *public administration*, while women's injuries were most prevalent in *health care and social assistance, other industries*, and *education and training* sectors. These findings provide insights into OHS trends during this ..

The last 2 charts demonstrate data spanning from *2017-2018* to *2021-2022*, it becomes evident that the prevalence of common injury types and causes has shown *relative stability*.

Notably, *sprains, strains or dislocations*, remain the *most frequent injury types*, with a marginal 1.2% decrease compared to the previous period. However, *chronic joint or muscle conditions* have seen a *notable 3.8% increase*.

In terms of injury causes, "*other reasons*" have *surged by 4%*, while incidents involving being struck or cut by objects or vehicles have decreased by 4%. Nevertheless, *lifting, pushing, or bending* activities *persist as significant contributors* to workplace injuries. These trends underscore the importance of *sustained safety efforts* in the workplace…

By Occupation

Men

Technicians and trade workers 24.20 %
Community and personal
Labourers 14.80%
Other occupations 22.30 %
Machinery operators and

Women

Other occupations 28.50%
Professionals 20.50%
Community and personal service workers
Labourers 10.00%
Technicians and trade

By Industry

Men

Retail trade 8.60 %
Public administration
Other industries 35.20%
Construction 17.00%
Transport, postal and

Women

Health care and social assistance 27.10 %
Other industries 24.50%
Retail trade 11.00 %
Education and training

Injury Types

- Sprain, strain or dislocations — ▼1.20%
- Chronic joint or muscle condition — ▲3.80%
- Other injuries — ▲2.60%
- Cut or open wound — ▼3.50%
- Fracture or broken bone — ▼0.10%
- Crushing injury, internal organ damage or bruising — ▼2.40%
- Stress or other mental health condition — ▲1.20%
- Burns (includes friction burns) — ▼0.20%

MOST changes compared with 2017-2018. Ranked the same (No. 2) as 2017-2018.

2017-2018   2021-2022

Injury Rate

Injury Causes

- Lifting, pushing, pulling, bending — ▼0.10%
- Other reasons — ▲4.00%
- Slip, trip, stumble (fall on same level) — ▲2.50%
- Hitting or being hit or cut by an object or vehicle (includes bumping into object) — ▼4.50%
- Repetitive movement — ▲0.30%
- Stress or exposure to mental stress — ▼1.00%
- Fall from a height — ▼0.70%
- Vehicle accident or incident — ▼1.20%
- Prolonged standing, working in cramped or unchanging positions — ▲0.70%

MOST changes compared with 2017-2018

2017-2018   2021-2022

Injury Rate

Visualization created by Minhua Zhou
Data source: Australian Bureau of Statistics
Image source: National Careers Institute

Figure 2. Dashboard lower part view

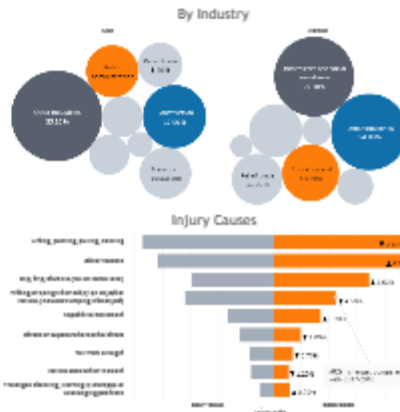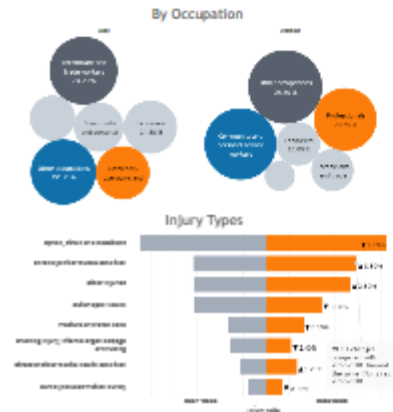Figure 3. Australian Job Image

Figure 4. Dashboard overview

Appendices

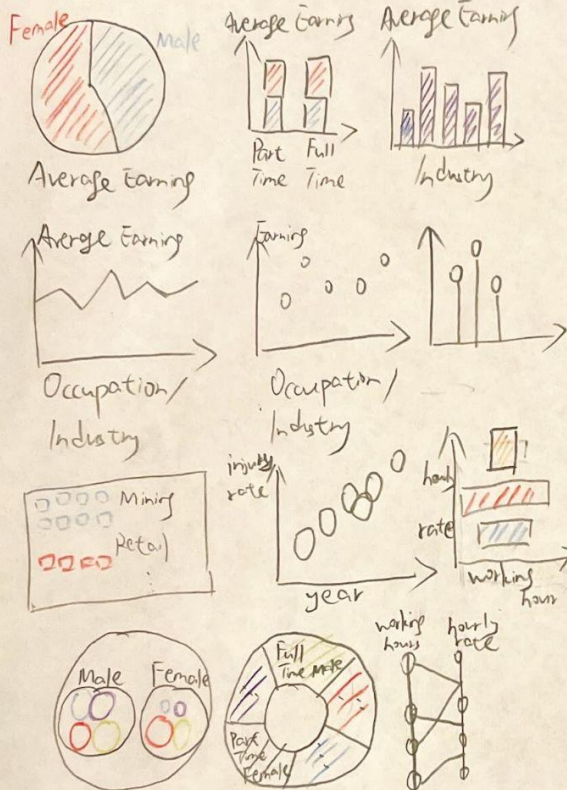A. See the next page for 5 design sheets.

Appendix A

Title: Design idea
Author: MINHUA ZHOU
Date: 3/8/2023
Sheet: 1
Task: Brainstorming

1. Ideas

Female — Male
Average Earning

Average Earning
Part Time / Full Time

Average Earning
Industry

Average Earning
Occupation / Industry

Earning
Occupation / Industry

injury rate
year

Mining
Retail

Male Female

Full Time Male
Part Time Female

working hours / hourly rate
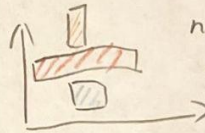
hourly rate × working hours

2. Filter

not so suitable as by universal perspective on a pie chart, it should demonstrate ratio comparison instead of actual numbers like wage
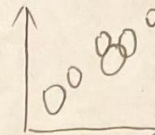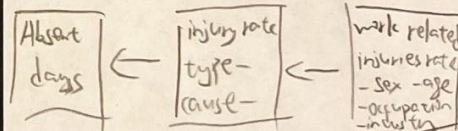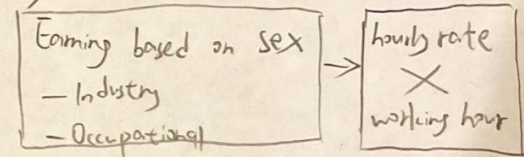
bubble chart is mostly used if we have relatively huge dataset and show the density, with the current dataset quantity, it doesn't seem reasonable
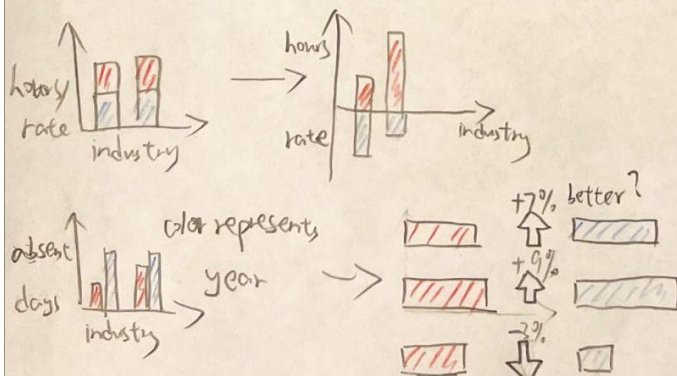
not an ideal approach to demonstrate the comparison

3. Categorize

Average earning based on sex and employment status

Earning based on sex
— Industry
— Occupation

hourly rate × working hour

Absent days ← injury rate type — cause — ← work related injuries rate — sex — age — occupation — industry

4. Combine and Refine

hourly rate / Industry → hours / rate / Industry

absent days / Industry
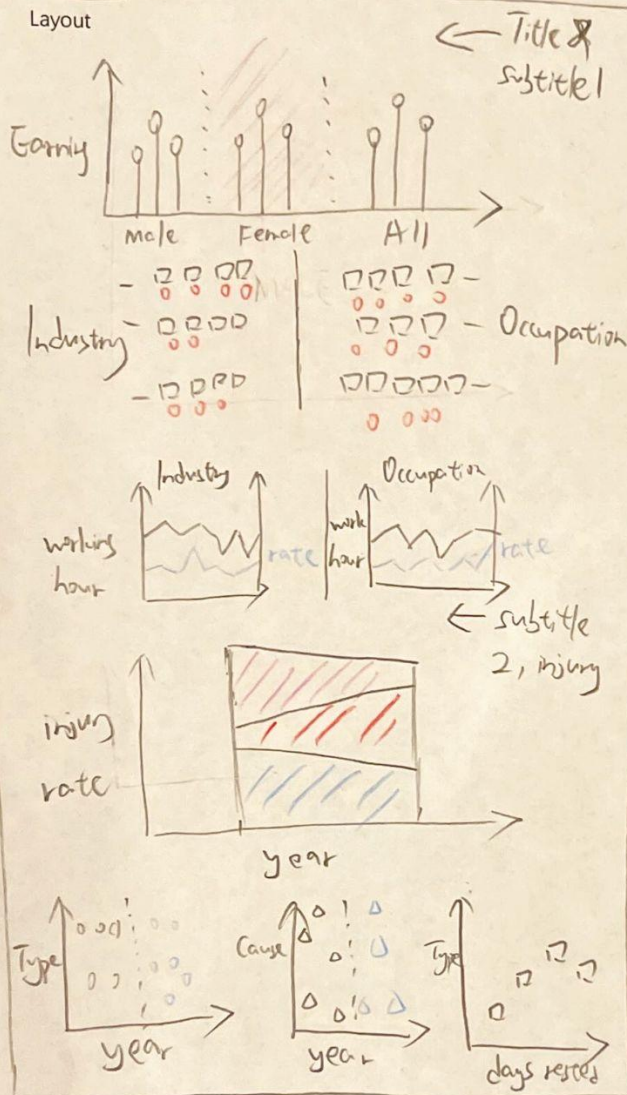color represents year →

+7% better?
+9%
-2%

The dot matrix could be represented with different shapes

5. Question
1. Is bar chart the clearest idiom to represent all data?
2. Is the donut chart suitable to show average earnings?
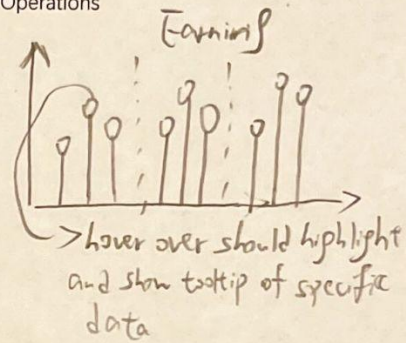3. What should be the main component?

Layout

Title &
subtitle

Earning

male   Female   All

Industry   Occupation

Industry — working hour — rate
Occupation — work hour — rate

subtitle 2, injury

injury rate

year

Type — year
Cause — year
Type — days rested

Operations

Earning

→ hover over should highlight and show tooltip of specific data

☐ part-time   ☑ male
☑ Full-time   ☑ Female

Filters should show specific regions
  enable   only

Injury — Work Related

Type — year   Type — days rested

Selecting one type should highlight relative point on both graphs

Focus

(swap) Maybe feasible?

Summarising the average weekly earnings put on top to show the highlighting point

similar as above, placed under section subtitle
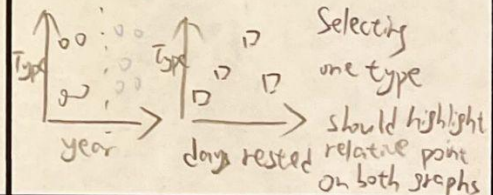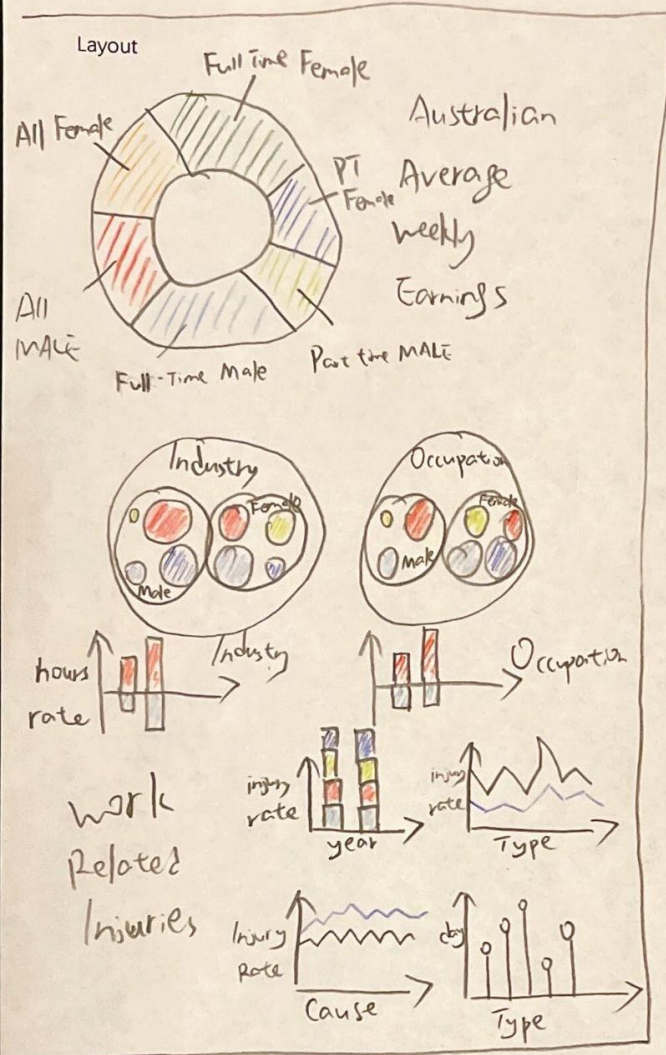
Filters will be added to both graphs
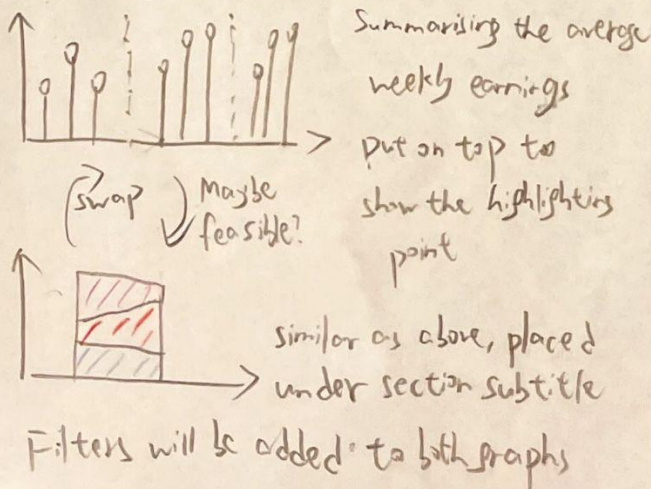
Discussion

Pros
1. layout follows symmetric balance and clear sightlines.

Cons
1. Dot matrix may not be clear enough to show comparisons for several categorical attributes

Question
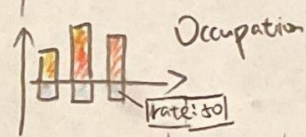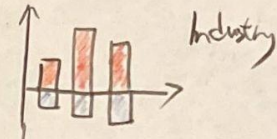1. Better idioms?
2. logical story telling? What connections?

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Layout

All Female

Full Time Female

Full-Time Male

PT Female

Part time MALE

All MALE

Australian Average Weekly Earnings

Industry

Occupation

Female

Male

hours rate — Industry

Occupation

Work Related Injuries

injury rate / year

injury rate / Type

Injury Rate / Cause

day / Type

Operations

Industry

Occupation

rate: 50

☑ Mining ☐ Retail ☐ ...

Filter available, tooltip shown when hovering over a specific sector

Industry / Occupation

earning
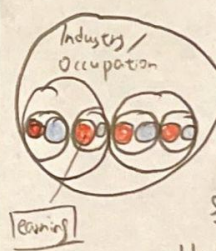
If any of the above filter is ticked/unticked, the proportional symbol should be added/removed respectively

Focus

Industry/Occupation

M   F
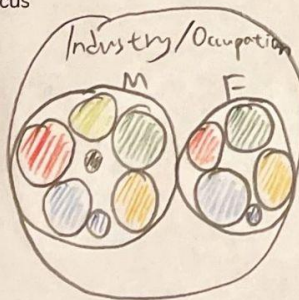
☐ mining ☐ Retail ☐ --

The proportional symbol chart utilizes the size & color hue to reflect comparison. The size will be determined based on the actual earning

possible scale legend could be included to show the data range like
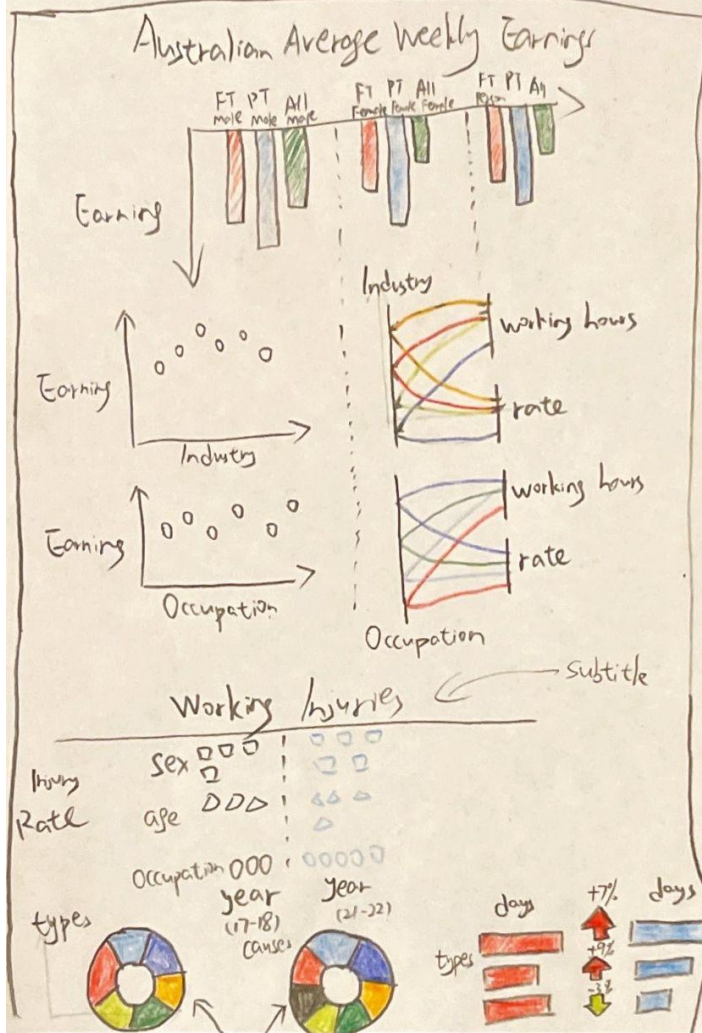
$ 7000 10000 30000

Discussion

Cons

1. The donut chart may not be clear enough to demonstrate the exact data and the comparison

2. The proportional symbol chart may become quite huge and some category may not be so noticeable

Pros

1. The stacked bar chart for hourly rate and working hours is clear to demonstrate the relationship between these two.
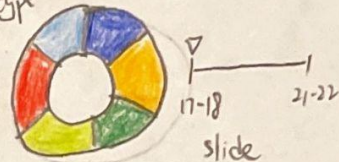
15

Layout

Australian Average Weekly Earnings

FT PT All | FT PT All | FT PT All
male male more | Female Female Female | Male

Earning

Earning — Industry

Earning — Occupation

Industry: working hours / rate

Occupation: working hours / rate

Subtitle

Working Injuries

Injury Rate
- Sex
- age
- Occupation
- year (17-18) Causes
- year (21-22)

types

days +7% days

types +7% +9% -3%

Operations

type

17-18   21-22
slide

cause

Due to lack of data at the moment, the year is only 17-18 & 21-22. However, this will be good for future extension when there are more years of data collected

injury percent 20%

tooltip shown on hover

days +7% days

rank [high→low / low→high]

This would allow us to sort the injury that could cause most absent days

Focus

using 21-22 only

Industry — hours / rate

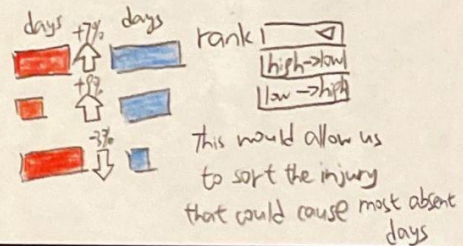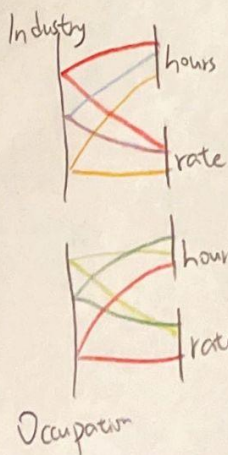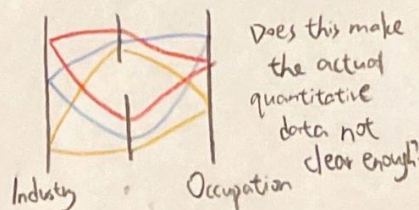Occupation — hours / rate

It is Similar to a combination of line charts or parallel coordinate plot

Detailed implementation would subject to change.

It could be combined & refined

Industry   Occupation

Does this make the actual quantitative data not clear enough?

Discussion

Pros
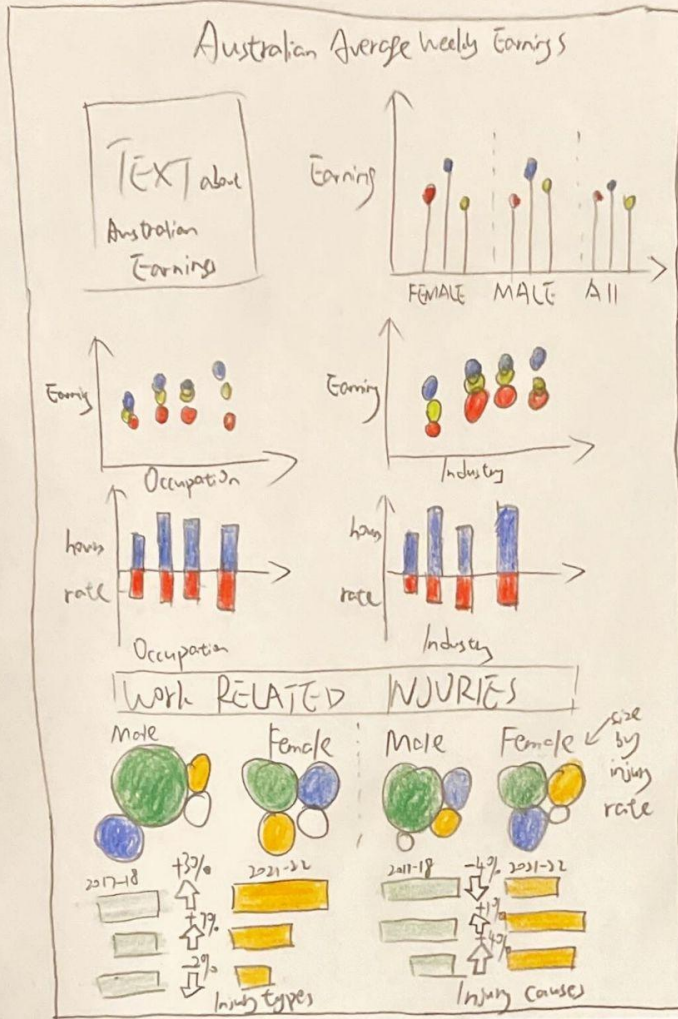1. The bar chart with up/down symbol demonstrates change over time or comparison well

Cons
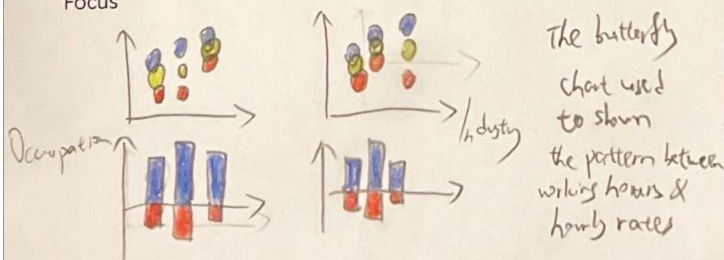1. For the donut chart, currently it is not suitable enough for year comparison

Question
1. Is it good to use upside down bar charts?

2. Does the current layout make attractive storytelling?

Layout

Australian Average Weekly Earnings

TEXT about Australian Earnings

Earning — FEMALE MALE All

Earning — Occupation

Earning — Industry

hours rate — Occupation

hours rate — Industry

WORK RELATED INJURIES

Male Female Male Female ← size by injury rate

2017-18 +3% 2021-22   2011-18 -4% 2021-22
+7%
+1%
-2%

Injury types   Injury causes

Operations

1. hover over should show the tooltips and/or highlight the specific data point/line

2. The chart for injury types & injury causes could be sorted
   asc ▽
   desc

3. Filters shall be applied for categorical attributes like occupation or industry

4. Graphs sharing similar categorical attributes should be associated and change together when filters are applied

Focus

Occupation

Industry

The butterfly chart used to show the pattern between working hours & hourly rates

layout structured in this way for smoother storytelling.
row: 1. average weekly earning, 2. hourly rate vs working hours
column: 1. Occupation 2. Industry
Clear sightlines & symmetrical balance

Details

1. No special algorithm would be applied

2. Tableau would be used for data visualization
   Manual modification for data cleaning

3. Time 1 hour for each chart
   2 hours for layout & text
   3 hours for report

4. no specific requirement
   Sheet size Automatic