

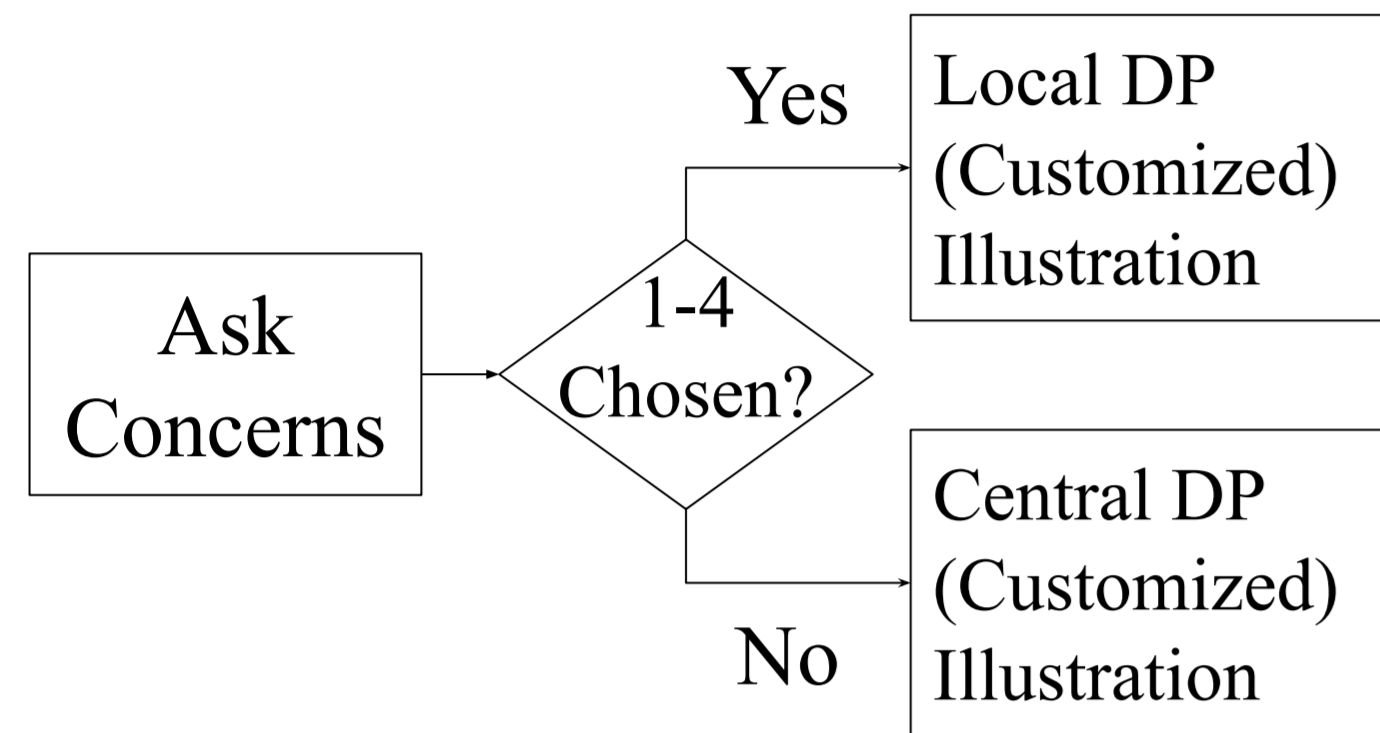
# New Differential Privacy Communication Pipeline and Design Framework

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## Communication Pipeline



## Possible Privacy Concerns

- Local DP**
1. Hack
  2. Law
  3. Organization
  4. Disclosure

- Central DP**
5. Analyst
  6. Graphs
  7. Share

## Findings

- All participants needed local DP to address their concerns.
- Text-based method is clear but less persuasive for central DP.
- Step-by-step interactive storyboards show great potential for central DP.

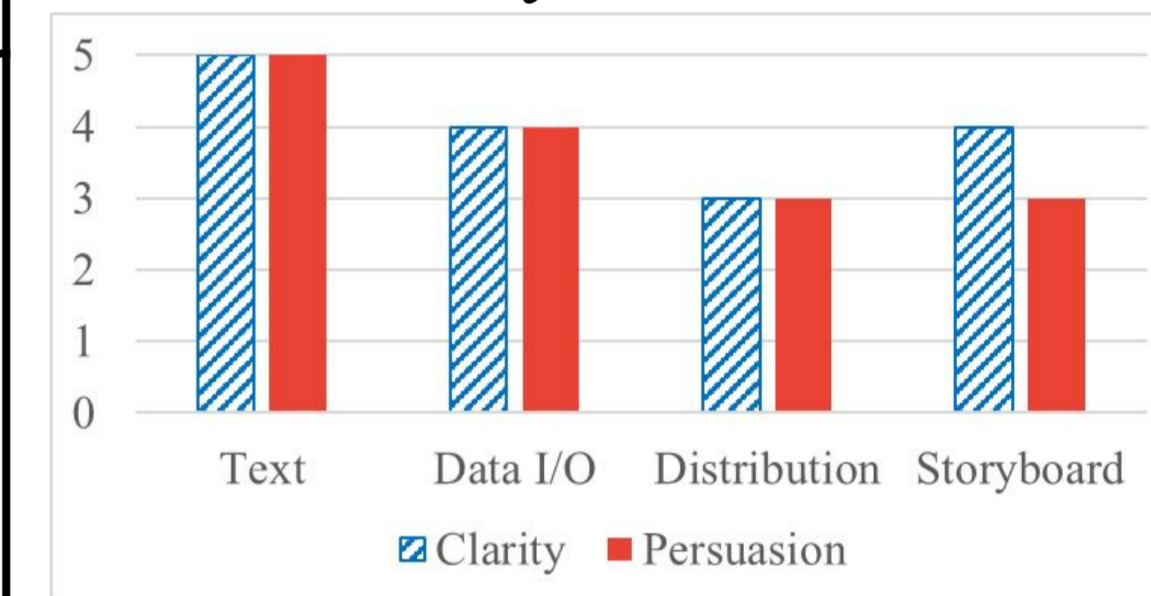
## 4 Types of Designs for DP Communication in Protecting Salary Data Privacy

Local DP	<p><b>Text:</b> The local DP mechanism will send your real data or processed non-real data with some probability ... neither the data collector nor the analyst can accurately infer your real data.</p>	<p><b>Data I/O</b></p>	<p><b>Data Distribution</b></p> <table border="1"> <thead> <tr> <th>work-salary</th> <th>probability</th> </tr> </thead> <tbody> <tr><td>farmer less than 5000 ¥</td><td>25%</td></tr> <tr><td>farmer 5000-10000 ¥</td><td>5%</td></tr> <tr><td>farmer 10000-20000 ¥</td><td>5%</td></tr> <tr><td>farmer more than 20000元</td><td>5%</td></tr> <tr><td>worker less than 5000 ¥</td><td>5%</td></tr> <tr><td>worker 5000-10000 ¥</td><td>5%</td></tr> <tr><td>worker 10000-20000 ¥</td><td>5%</td></tr> <tr><td>worker more than 20000 ¥</td><td>5%</td></tr> <tr><td>doctor less than 5000 ¥</td><td>5%</td></tr> <tr><td>doctor 5000-10000 ¥</td><td>5%</td></tr> <tr><td>doctor 10000-20000 ¥</td><td>5%</td></tr> <tr><td>doctor more than 20000 ¥</td><td>5%</td></tr> <tr><td>teacher less than 5000 ¥</td><td>5%</td></tr> <tr><td>teacher 5000-10000 ¥</td><td>5%</td></tr> <tr><td>teacher 10000-20000 ¥</td><td>5%</td></tr> <tr><td>teacher more than 20000 ¥</td><td>5%</td></tr> </tbody> </table>	work-salary	probability	farmer less than 5000 ¥	25%	farmer 5000-10000 ¥	5%	farmer 10000-20000 ¥	5%	farmer more than 20000元	5%	worker less than 5000 ¥	5%	worker 5000-10000 ¥	5%	worker 10000-20000 ¥	5%	worker more than 20000 ¥	5%	doctor less than 5000 ¥	5%	doctor 5000-10000 ¥	5%	doctor 10000-20000 ¥	5%	doctor more than 20000 ¥	5%	teacher less than 5000 ¥	5%	teacher 5000-10000 ¥	5%	teacher 10000-20000 ¥	5%	teacher more than 20000 ¥	5%																																						
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Central DP	<p><b>Text:</b> In central DP, you will send real data to the data collector ... the analyst is difficult to infer your real data from the noisy result.</p>	<p><b>Data I/O</b></p> <table border="1"> <thead> <tr> <th colspan="2">Collector View</th> <th colspan="2">Analyzer View</th> </tr> <tr> <th>Job-Salary</th> <th>Counting</th> <th>job-salary</th> <th>counting</th> </tr> </thead> <tbody> <tr><td>farmer less than 5000 ¥</td><td>41</td><td>farmer less than 5000 ¥</td><td>46</td></tr> <tr><td>farmer 5000-10000 ¥</td><td>60</td><td>farmer 5000-10000 ¥</td><td>63</td></tr> <tr><td>farmer 10000-20000 ¥</td><td>120</td><td>farmer 10000-20000 ¥</td><td>116</td></tr> <tr><td>farmer more than 20000 ¥</td><td>60</td><td>farmer more than 20000 ¥</td><td>62</td></tr> <tr><td>worker less than 5000 ¥</td><td>150</td><td>worker less than 5000 ¥</td><td>145</td></tr> <tr><td>worker 5000-10000 ¥</td><td>80</td><td>worker 5000-10000 ¥</td><td>89</td></tr> <tr><td>worker 10000-20000 ¥</td><td>90</td><td>worker 10000-20000 ¥</td><td>100</td></tr> <tr><td>worker more than 20000 ¥</td><td>30</td><td>worker more than 20000 ¥</td><td>29</td></tr> <tr><td>doctor less than 5000 ¥</td><td>60</td><td>doctor less than 5000 ¥</td><td>61</td></tr> <tr><td>doctor 5000-10000 ¥</td><td>80</td><td>doctor 5000-10000 ¥</td><td>85</td></tr> <tr><td>doctor 10000-20000 ¥</td><td>40</td><td>doctor 10000-20000 ¥</td><td>44</td></tr> <tr><td>doctor more than 20000 ¥</td><td>20</td><td>doctor more than 20000 ¥</td><td>23</td></tr> <tr><td>teacher less than 5000 ¥</td><td>90</td><td>teacher less than 5000 ¥</td><td>84</td></tr> <tr><td>teacher 5000-10000 ¥</td><td>240</td><td>teacher 5000-10000 ¥</td><td>231</td></tr> <tr><td>teacher 10000-20000 ¥</td><td>190</td><td>teacher 10000-20000 ¥</td><td>189</td></tr> <tr><td>teacher more than 20000 ¥</td><td>50</td><td>teacher more than 20000 ¥</td><td>46</td></tr> </tbody> </table>	Collector View		Analyzer View		Job-Salary	Counting	job-salary	counting	farmer less than 5000 ¥	41	farmer less than 5000 ¥	46	farmer 5000-10000 ¥	60	farmer 5000-10000 ¥	63	farmer 10000-20000 ¥	120	farmer 10000-20000 ¥	116	farmer more than 20000 ¥	60	farmer more than 20000 ¥	62	worker less than 5000 ¥	150	worker less than 5000 ¥	145	worker 5000-10000 ¥	80	worker 5000-10000 ¥	89	worker 10000-20000 ¥	90	worker 10000-20000 ¥	100	worker more than 20000 ¥	30	worker more than 20000 ¥	29	doctor less than 5000 ¥	60	doctor less than 5000 ¥	61	doctor 5000-10000 ¥	80	doctor 5000-10000 ¥	85	doctor 10000-20000 ¥	40	doctor 10000-20000 ¥	44	doctor more than 20000 ¥	20	doctor more than 20000 ¥	23	teacher less than 5000 ¥	90	teacher less than 5000 ¥	84	teacher 5000-10000 ¥	240	teacher 5000-10000 ¥	231	teacher 10000-20000 ¥	190	teacher 10000-20000 ¥	189	teacher more than 20000 ¥	50	teacher more than 20000 ¥	46	<p><b>Data Distribution</b></p>
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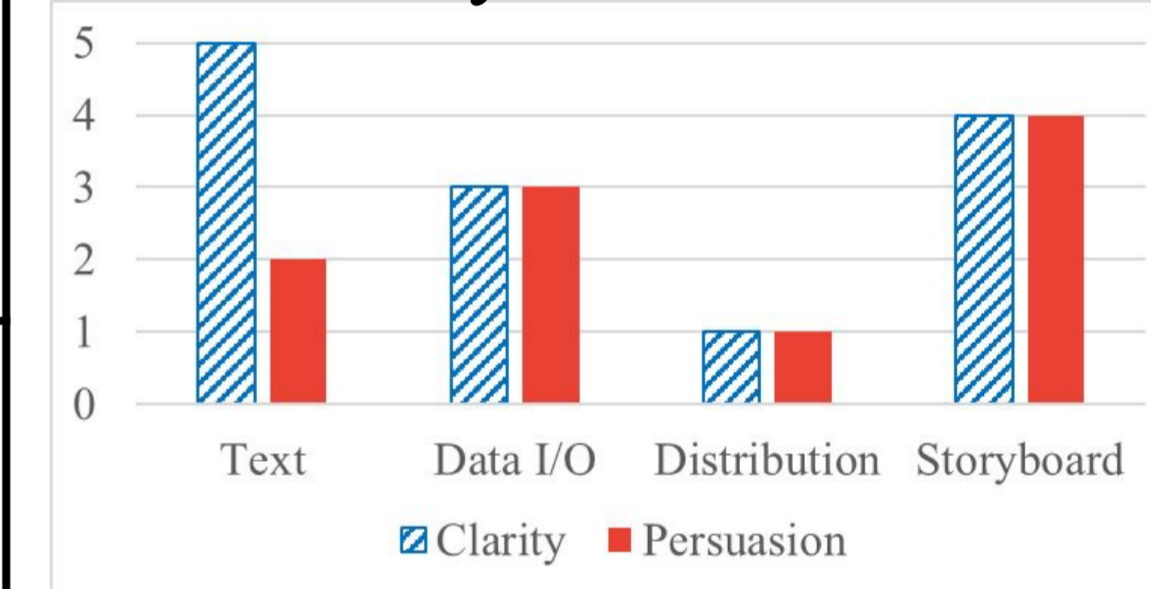
## Evaluation Results

- Designs for 2 types of data sharing: salary and location.
- # of people agreed or strongly agreed the design is clear or persuasive (total 5).

Salary - Local DP



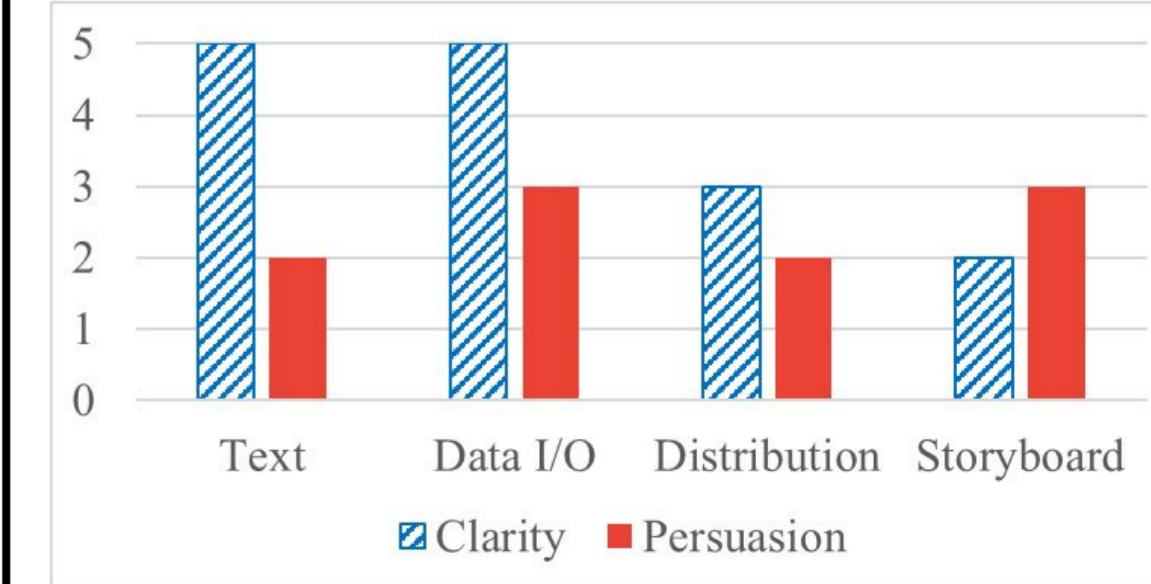
Salary - Central DP



Location - Local DP



Location - Central DP



This study received the ethical approval of Guangzhou University.