Physical Logging

states (byte images) are logged

**before image** contains state **before** change was performed

**after image** contains state **after** change was performed
Logical Logging

high-level operations are logged

not necessarily limited to a single page

```
CameraLingo: update(0, 'Kemera' => 'camera')
```
Physiological Logging

like logical logging, but:

log entry **may only affect a single page**

- Example: for capital character
  
  $\Rightarrow \exists$ log record

Page 42

- lens
- aperture
- Kemera
- depth of field

Page 42

- lens
- aperture
- camera
- depth of field

Log

Page 42: update(0, ‘Kemera’ => ‘camera’)
Main Performance Trade-Off (disk-based Systems)

log entry processing time
[minutes]

log-size \approx I/O-time to read log

logical (transactions)

logical (logical operations)
  e.g. insert/delete to table

physiological

physical
Main Performance Trade-Off (Main Memory Systems)

log entry processing time [ms]

log entry processing time [ms]

logical (transactions)

logical (logical operations)

physiological

physical

best deal

log-size ≈ I/O-time to read log
Logical Logging Example in Main Memory

just store the invocation parameters of the stored procedure in the log

<table>
<thead>
<tr>
<th>queryID</th>
<th>SQL</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>UPDATE CameraLingo SET term=$A WHERE term=$B</td>
</tr>
<tr>
<td>1</td>
<td>INSERT INTO CameraLingo VALUES ($A,$B)</td>
</tr>
<tr>
<td>2</td>
<td>DELETE FROM CameraLingo WHERE term=$A</td>
</tr>
</tbody>
</table>

Log

2:‘lens’
0:‘camera’:‘Kemera’
1:42:‘tripod’