

The slide features a red header with the MobLab logo and tagline 'A playground for decisions'. Below the header, the title 'Robot Dogs' is displayed in a large, bold, black font, with the subtitle 'A Classroom Experiment on Externalities' in a smaller, blue font. The background is white with a grey gradient at the bottom. On the left side, there is a vertical strip of icons representing various economic concepts: a person at a computer, a house, a person at a desk, and a person at a computer. The MobLab logo is also present in the bottom left corner.

**MobLab**  
A playground for decisions

**Robot Dogs**  
A Classroom Experiment on Externalities

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## RobotDogs: Barking Up the Wrong Tree

### Overview: Each Round

- Half in each market are buyers and half are sellers
- Transactions occur between buyers and sellers
- Each RobotDog's barking imposes a nuisance cost equally shared by all

### Overview: Transacting

- Students can buy or sell one RobotDog at a time
- Buyers submit bids, or an offer to buy
- Sellers submit asks, or an offer to sell
- When a bid > ask, we have a sale!

## Game Screen

### Information on role and nuisance cost

Hi Neighbor!



You would like to buy 2 RobotDogs, each of which has a unique value.



RobotDogs bark and disturb everyone!  
For each RobotDog bought, the nuisance is:

**\$0.10**/person

Start

## Game Screen

### RobotDog barking

RobotDog Market
Inventory
Market Log

### BUYER

🐕 0 / 2

costs per transaction  
personal nuisance **-\*0.10**

**\$6.80** - **\$0.00** personal nuisance **0.10** = **\$6.70**  
your value bid total costs payoff

←  →

Place Bid
Buy Lowest Ask

#### Recent Prices

- ¥3.95
- ¥4.53
- ¥4.05

BIDS	ASKS
¥3.61	¥4.01
¥3.35	¥4.02
¥3.30	¥4.48

## Game Screen

Previous prices in this market

RobotDog Market | Inventory | **Market Log**

**BUYER**

0 / 2

costs per transaction  
personal nuisance -0.10

\$6.80 your value - \$0.00 bid + personal nuisance 1.10 = \$6.70 total costs = \$6.70 payoff

Place Bid

Buy Lowest Ask

Recent Prices

\$3.95
\$4.53
\$4.05

BIDS	ASKS
\$3.61	\$4.01
\$3.35	\$4.02
\$3.30	\$4.48

MobLab™ | 16 | 01:29

## Buyer's Screen

RobotDog value

RobotDog Market | Inventory | Market Log

**BUYER**

0 / 2

costs per transaction  
personal nuisance -0.10

**\$6.80** your value - \$0.00 bid + personal nuisance 1.10 = \$6.70 total costs = \$6.70 payoff

Place Bid

Buy Lowest Ask

Recent Prices

\$3.95
\$4.53
\$4.05

BIDS	ASKS
\$3.61	\$4.01
\$3.35	\$4.02
\$3.30	\$4.48

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## Buyer's Screen

Slide to desired bid

Press to submit

RobotDog Market | Inventory | Market Log

**BUYER**

0 / 2

costs per transaction  
personal nuisance -0.10

\$6.80 your value  
\$3.80 bid  
personal nuisance 0.10  
total costs = \$2.90 payoff

Place Bid

Buy Lowest Ask

Recent Prices

\$3.61
\$3.95
\$4.53

BIDS

\$3.38
\$3.35
\$3.02

ASKS

\$3.63
\$3.83
\$4.01

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16 01:06

## Buyer's Screen

Market's current offers

RobotDog Market | Inventory | Market Log

**BUYER**

0 / 2

costs per transaction  
personal nuisance -0.10

\$6.80 your value  
\$3.80 bid  
personal nuisance 0.10  
total costs = \$2.90 payoff

Place Bid

Buy Lowest Ask

Recent Prices

\$3.61
\$3.95
\$4.53

BIDS

\$3.38
\$3.35
\$3.02

ASKS

\$3.63
\$3.83
\$4.01

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## Buyer's Screen

**RobotDog Market** | Inventory | Market Log

**BUYER**

RobotDog icon | 0 / 2

costs per transaction  
personal nuisance -0.10

\$6.80 your value - \$3.80 bid + personal nuisance 0.10 = \$2.90 payoff

Recent Prices: \$3.61, \$3.95, \$4.53

BIDS	ASKS
\$3.88	\$3.63
\$3.85	\$3.83
\$3.02	\$4.01

Place Bid | Buy Lowest Ask

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## Seller's Screen

RobotDog cost if you sell

Personal nuisance cost

**RobotDog Market** | Inventory | Market Log

**SELLER**

RobotDog icon | 2 / 2

costs per transaction  
personal nuisance -0.10

\$4.00 ask - \$1.70 your cost - \$0.10 personal nuisance = \$2.20 payoff

Recent Prices: \$4.50, \$4.17, \$4.45

BIDS	ASKS
\$3.87	\$4.73
\$3.69	\$4.74
\$3.37	\$4.86

Place Ask | Sell at Highest Bid

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## Seller's Screen

Slide to desired ask

Press to submit

RobotDog Market | Inventory | Market Log

**SELLER**

RobotDog icon | 2 / 2

costs per transaction  
personal nuisance - \$0.10

$\$4.00$  ask -  $\$1.70$  your cost + personal nuisance  $0.10$  =  $\$2.20$  total costs =  $\$2.20$  payoff

Recent Prices

\$4.50
\$4.17
\$4.45

BIDS | ASKS

\$3.87	\$4.73
\$3.69	\$4.74
\$3.37	\$4.86

Place Ask | Sell at Highest Bid

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## Seller's Screen

Market's current bids

RobotDog Market | Inventory | Market Log

**SELLER**

RobotDog icon | 2 / 2

costs per transaction  
personal nuisance - \$0.10

$\$4.00$  ask -  $\$1.70$  your cost + personal nuisance  $0.10$  =  $\$2.20$  total costs =  $\$2.20$  payoff

Recent Prices

\$4.50
\$4.17
\$4.45

BIDS | ASKS

\$3.87	\$4.73
\$3.69	\$4.74
\$3.37	\$4.86

Place Ask | Sell at Highest Bid

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## Seller's Screen

The screenshot displays the Seller's interface for the RobotDog Market. At the top, there are tabs for 'RobotDog Market', 'Inventory', and 'Market Log'. The main section is titled 'SELLER' and features a robot dog icon and a '2 / 2' indicator. Below the icon, it shows 'costs per transaction' and 'personal nuisance' as  $-\$0.10$ . A central calculation shows:  $\$4.00$  ask minus  $\$1.70$  your cost plus  $\$0.10$  personal nuisance equals  $\$2.20$  total costs, resulting in a  $\$2.20$  payoff. A slider is positioned between  $\$4.00$  and  $\$1.70$ . At the bottom, there are two buttons: 'Place Ask' and 'Sell at Highest Bid'. The 'Sell at Highest Bid' button is circled in red, with a red arrow pointing to it from the text 'Sell button' above. To the right, there are sections for 'Recent Prices' (listing  $\$4.50$ ,  $\$4.17$ , and  $\$4.45$ ), and 'BIDS' and 'ASKS' tables. The 'BIDS' table lists  $\$3.87$ ,  $\$3.69$ , and  $\$3.37$ . The 'ASKS' table lists  $\$4.73$ ,  $\$4.74$ , and  $\$4.86$ . The bottom navigation bar includes a home icon, a list icon, a user icon with '16', a clock showing '01:22', and a robot dog icon.

## Summary

### You buy a RobotDog if

- You click **Buy at the Lowest Ask**, OR
- You have the highest Bid and a seller accepts highest bid

### You sell a RobotDog if

- You click **Sell at the Highest Bid**, OR
- You have the lowest Ask and a buyer accepts lowest ask

## Payoffs

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### Buyer: Each RobotDog you buy

- Payoff = RobotDog value – Price paid – Personal nuisance cost

### Seller: Each RobotDog you sell

- Payoff = Price fetched – RobotDog cost – Personal nuisance cost

### Nuisance cost from others

- Others' RobotDogs × Personal nuisance cost

## Payoffs

---

### Buyer: Each RobotDog you buy

- Payoff = RobotDog value – Price paid – Personal nuisance cost

### Seller: Each RobotDog you sell

- Payoff = Price fetched – RobotDog cost – Personal nuisance cost

### Nuisance cost from others

- Others' RobotDogs × Personal nuisance cost

### Remember

- Total payoff = sum of payoff from transactions minus nuisance cost imposed by others
- The value (or cost) of each item is indicated on your screen
- **A negative number is smaller than zero!**



## Payoffs: An Example

- Consider 1 transaction.
  - Value to buyer: \$2
  - Cost to seller: \$1
  - Price agreement: \$1.75
- Group size = 10
- Community nuisance: \$0.50 per RobotDog

## Payoffs: An Example

- Consider 1 transaction.
  - Value to buyer: \$2
  - Cost to seller: \$1
  - Price agreement: \$1.75
- Group size = 10
- Community nuisance: \$0.50 per RobotDog

<b>Buyer</b>	-	<b>Personal Nuisance Cost</b>
	-	\$0.05
<b>Seller</b>	-	<b>Personal Nuisance Cost</b>
	-	\$0.05

## Payoffs: An Example

- Consider 1 transaction.
  - Value to buyer: \$2
  - Cost to seller: \$1
  - Price agreement: \$1.75
- Group size = 10
- Community nuisance: \$0.50 per RobotDog

<b>Buyer</b>	<b>Value</b>	<b>-</b>	<b>Price</b>	<b>-</b>	<b>Personal Nuisance Cost</b>	<b>=</b>	<b>Payoff</b>
	\$2.00	-	\$1.75	-	\$0.05	=	\$0.20
<b>Seller</b>				<b>-</b>	<b>Personal Nuisance Cost</b>		
				-	\$0.05		

## Payoffs: An Example

- Consider 1 transaction.
  - Value to buyer: \$2
  - Cost to seller: \$1
  - Price agreement: \$1.75
- Group size = 10
- Community nuisance: \$0.50 per RobotDog


<b>Buyer</b>	<b>Value</b>	<b>-</b>	<b>Price</b>	<b>-</b>	<b>Personal Nuisance Cost</b>	<b>=</b>	<b>Payoff</b>
	\$2.00	-	\$1.75	-	\$0.05	=	\$0.20
<b>Seller</b>	<b>Price</b>	<b>-</b>	<b>Cost</b>	<b>-</b>	<b>Personal Nuisance Cost</b>	<b>=</b>	<b>Payoff</b>
	\$1.75	-	\$1.00	-	\$0.05	=	\$0.70

## Payoffs: An Example

*Happy Playing!*


- Keep in mind for total payoff
  - Sum the payoff from all your transactions
  - Subtract nuisance cost you incur from others' transactions

<b>Buyer</b>	<b>Value</b>	<b>-</b>	<b>Price</b>	<b>-</b>	<b>Personal Nuisance Cost</b>	<b>=</b>	<b>Payoff</b>
	\$2.00	-	\$1.75	-	\$0.05	=	\$0.20
<b>Seller</b>	<b>Price</b>	<b>-</b>	<b>Cost</b>	<b>-</b>	<b>Personal Nuisance Cost</b>	<b>=</b>	<b>Payoff</b>
	\$1.75	-	\$1.00	-	\$0.05	=	\$0.70




# MobLab

A playground for decisions



## Robot Dogs with Taxation

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## Payoffs

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### Buyer: Each RobotDog you buy

- Payoff = RobotDog value – Price paid – Personal nuisance cost

### Seller: Each RobotDog you sell

- Payoff = Price fetched – RobotDog cost – Personal nuisance cost  
- [Tax](#)

### Nuisance cost from others

- Others' RobotDogs × Personal nuisance cost

## Payoffs

---

### Buyer: Each RobotDog you buy

- Payoff = RobotDog value – Price paid – Personal nuisance cost

### Seller: Each RobotDog you sell

- Payoff = Price fetched – RobotDog cost – Personal nuisance cost - [Tax](#)

### Nuisance cost from others

- Others' RobotDogs × Personal nuisance cost

### Remember

- Total payoff = sum of payoff from transactions minus nuisance cost imposed by others
- The value (or cost) of each item is indicated on your screen
- **A negative number is smaller than zero!**

## Payoffs: An Example

- Consider 1 transaction.
  - Value to buyer: \$4
  - Cost to seller: \$1
  - Price agreement: \$3.75
  - [Tax: \\$1.40](#)
- Group size = 10
- Community nuisance: \$0.50 per RobotDog

## Payoffs: An Example

- Consider 1 transaction.
  - Value to buyer: \$4
  - Cost to seller: \$1
  - Price agreement: \$3.75, [Tax: \\$1.40](#)
- Group size = 10
- Community nuisance: \$0.50 per RobotDog

Buyer	Personal Nuisance Cost	=	Payoff
Seller	Personal Nuisance Cost	- Tax	= Payoff

## Payoffs: An Example

- Consider 1 transaction.
  - Value to buyer: \$4
  - Cost to seller: \$1
  - Price agreement: \$3.75, [Tax: \\$1.40](#)
- Group size = 10
- Community nuisance: \$0.50 per RobotDog

<b>Buyer</b>	<b>Value</b>	<b>-</b>	<b>Price</b>	<b>-</b>	<b>Personal Nuisance Cost</b>	<b>=</b>	<b>Payoff</b>
	\$4.00	-	\$3.75	-	\$0.05	=	\$0.20
<b>Seller</b>					<b>Personal Nuisance Cost</b>	<b>-</b>	<b>Tax</b>
							<b>=</b>
							<b>Payoff</b>

## Payoffs: An Example

- Consider 1 transaction.
  - Value to buyer: \$4
  - Cost to seller: \$1
  - Price agreement: \$3.75, [Tax: \\$1.40](#)
- Group size = 10
- Community nuisance: \$0.50 per RobotDog


<b>Buyer %</b>	<b>Value</b>	<b>-</b>	<b>Price</b>	<b>-</b>	<b>Personal Nuisance Cost</b>	<b>=</b>	<b>Payoff</b>
	\$4.00	-	\$3.75	-	\$0.05	=	\$0.20
<b>Seller</b>	<b>Price</b>	<b>-</b>	<b>Cost</b>	<b>-</b>	<b>Personal Nuisance Cost</b>	<b>-</b>	<b>Tax</b>
	\$4.00	-	\$1.00	-	\$0.05	-	\$1.40
							<b>=</b>
							<b>Payoff</b>

## Payoffs: An Example

*Happy Playing!*


- Keep in mind for total payoff
  - Sum the payoff from all your transactions
  - Subtract nuisance cost you incur from others' transactions

<b>Buyer</b>	<b>Value</b>	<b>-</b>	<b>Price</b>	<b>-</b>	<b>Personal Nuisance Cost</b>	<b>=</b>	<b>Payoff</b>
	\$4.00	-	\$3.75	-	\$0.05	=	\$0.20
<b>Seller</b>	<b>Price</b>	<b>-</b>	<b>Cost</b>	<b>-</b>	<b>Personal Nuisance Cost</b>	<b>-</b>	<b>Tax = Payoff</b>
	\$4.00	-	\$1.00	-	\$0.05	-	\$1.40 = \$1.55




# MobLab

A playground for decisions



## Robot Dogs

PERMITS

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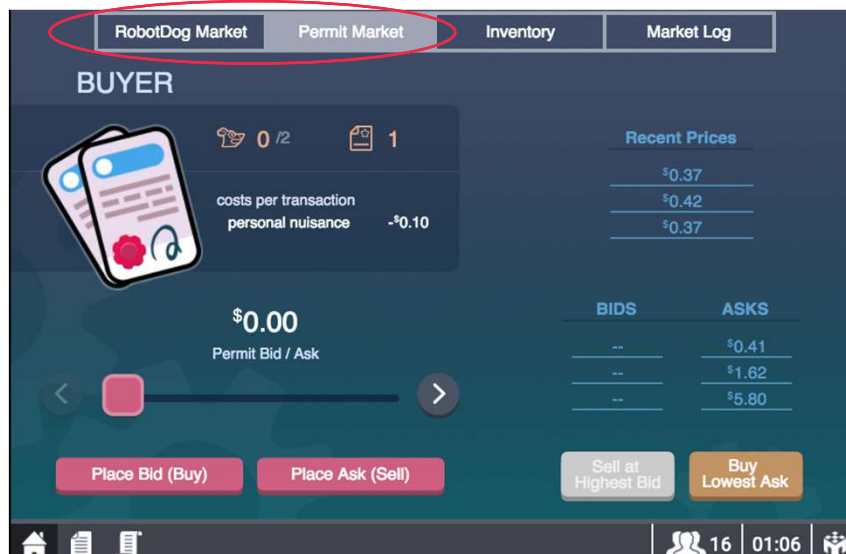
## RobotDogs – Using Permits

### A solution to the barking RobotDog nuisance?

- Each round, the government distributes a limited number of RobotDog permits
- A RobotDog buyer must have a permit
- If you have a permit, you can either
  - use it to purchase a RobotDog (if you are a RobotDog buyer)
  - sell it to someone who wants to buy a RobotDog
- The permit and RobotDogs markets simultaneously open
  - The permit market works like the market for RobotDogs (i.e., a permit is transacted when a bid  $\geq$  an ask)
- Permits expire at end of round

## Permit Market Screen

### Choose market to view



The screenshot shows the 'Permit Market' screen for a buyer. At the top, there are four tabs: 'RobotDog Market', 'Permit Market', 'Inventory', and 'Market Log'. The 'Permit Market' tab is selected. Below the tabs, the screen is divided into several sections:

- BUYER**: The user's role is identified as a buyer.
- Transaction Costs**: Shows 'costs per transaction' and 'personal nuisance' as  $-\$0.10$ .
- Permit Bid / Ask**: The current bid and ask price is  $\$0.00$ .
- Recent Prices**: A list of recent transaction prices:  $\$0.37$ ,  $\$0.42$ , and  $\$0.37$ .
- BIDS and ASKS**: A table showing the current market state:
 

BIDS	ASKS
--	$\$0.41$
--	$\$1.62$
--	$\$5.80$
- Action Buttons**: 'Place Bid (Buy)', 'Place Ask (Sell)', 'Sell at Highest Bid', and 'Buy Lowest Ask'.

The bottom of the screen shows a navigation bar with a home icon, a list icon, a document icon, a user icon with '16', a timer '01:06', and a refresh icon.



## Permit Market Screen

Your permits

The screenshot shows the 'Permit Market' screen with the following data:

RobotDog Market	Permit Market	Inventory	Market Log
<b>BUYER</b>			
0 / 2            1		<b>Recent Prices</b> \$0.37 \$0.42 \$0.37	
costs per transaction personal nuisance - \$0.10		<b>BIDS</b> <b>ASKS</b> --            \$0.41 --            \$1.62 --            \$5.80	
\$0.00 Permit Bid / Ask		Sell at Highest Bid    Buy Lowest Ask	
Place Bid (Buy)    Place Ask (Sell)		16    01:06	

## Permit Market Screen

Previous prices in both markets

The screenshot shows the 'Permit Market' screen with the following data:

RobotDog Market	Permit Market	Inventory	Market Log
<b>BUYER</b>			
0 / 2            1		<b>Recent Prices</b> \$0.16 \$0.15 \$0.37	
costs per transaction personal nuisance - \$0.10		<b>BIDS</b> <b>ASKS</b> \$0.00      \$1.54 --          \$1.64 --          \$2.05	
\$0.65 Permit Bid / Ask		Sell at Highest Bid    Buy Lowest Ask	
Place Bid (Buy)    Place Ask (Sell)		16    00:45	

## Permit Market Screen (Buyer)

RobotDog value

The screenshot shows the 'RobotDog Market' tab selected. The interface is for a 'BUYER' and includes the following elements:

- RobotDog Market** (highlighted with a red circle)
- BUYER** header
- Transaction status: 0 / 2 (hand icon) and 1 (document icon)
- Costs: costs per transaction, personal nuisance -\$0.10
- Current Permit Bid / Ask: **\$0.65**
- Slider control for the bid/ask price
- Buttons: Place Bid (Buy), Place Ask (Sell), Sell at Highest Bid, Buy Lowest Ask
- Recent Prices: \$0.16, \$0.15, \$0.37
- BIDS table: \$0.00, --, --
- ASKS table: \$1.54, \$1.64, \$2.05
- Footer: MobLab™, navigation icons, 16 users, 00:45 time

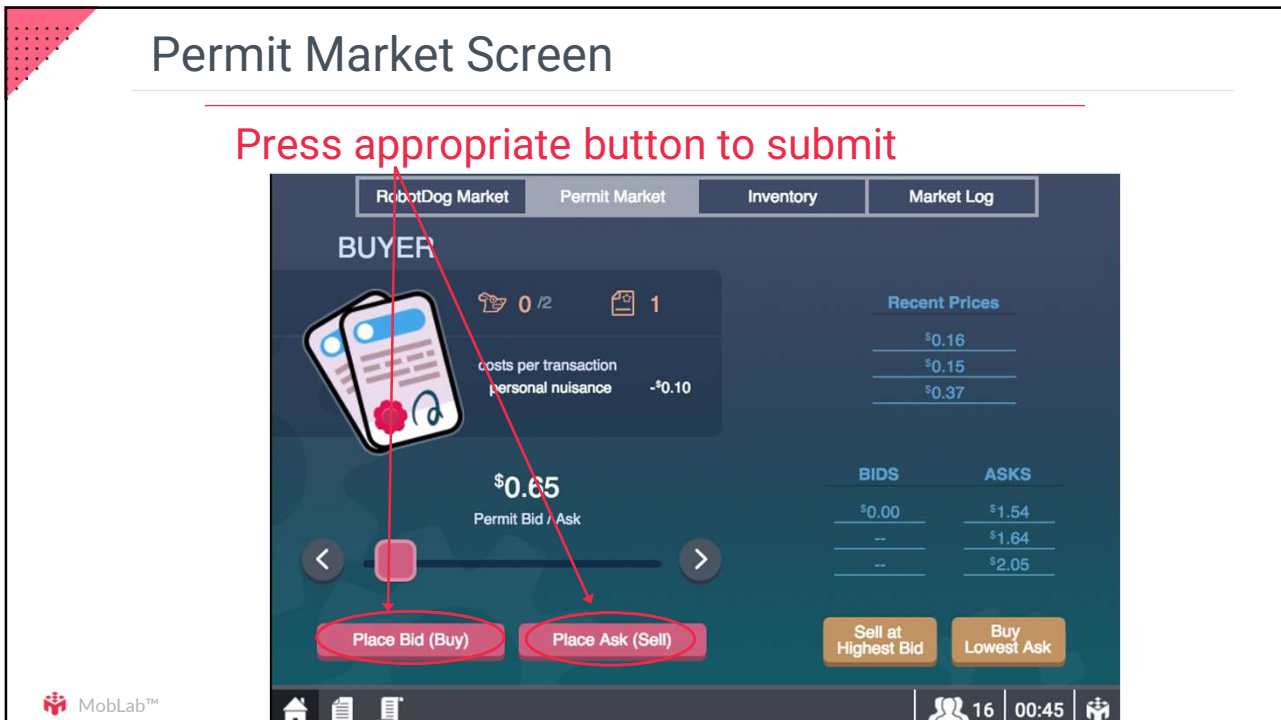
## Permit Market Screen

Slide to desired price

This screenshot is identical to the one above, but with a red arrow pointing to the slider control for the permit bid/ask price, which is currently set at \$0.65. The text 'Slide to desired price' is positioned above the arrow.

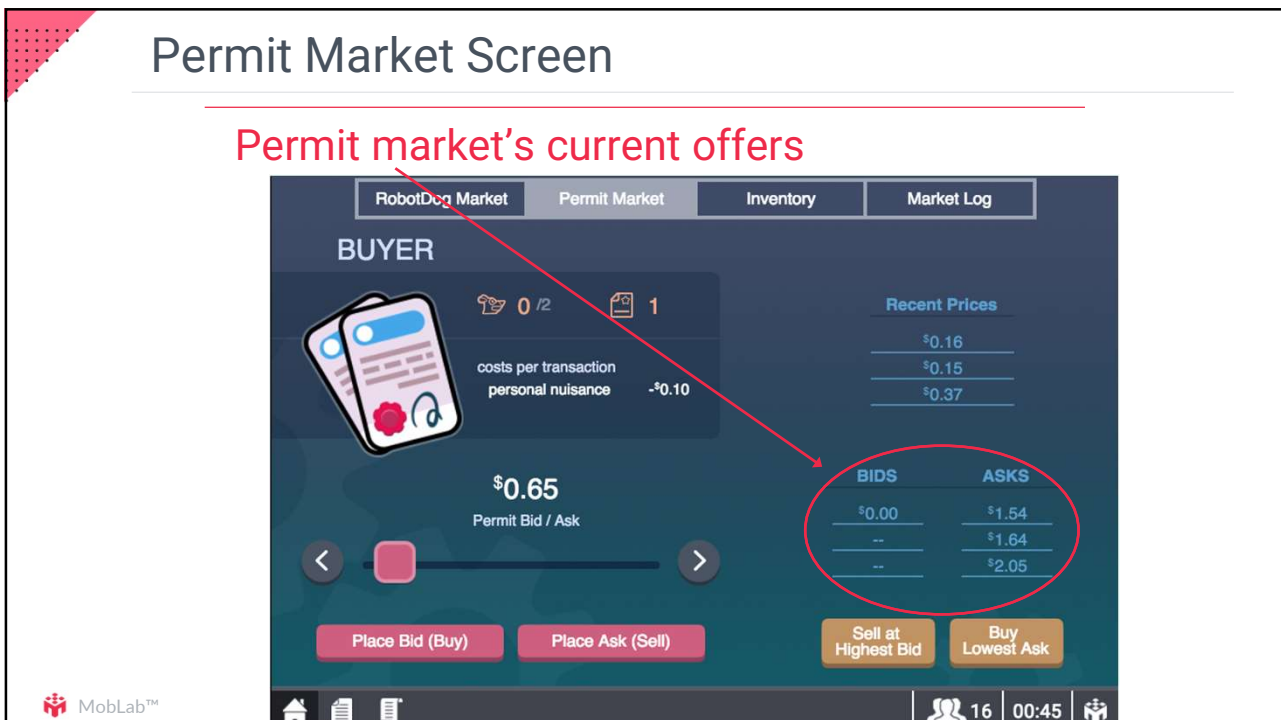
## Permit Market Screen

Press appropriate button to submit



## Permit Market Screen

Permit market's current offers



## Permit Market Screen

**Sell button**

The screenshot displays the 'Permit Market' interface. At the top, there are tabs for 'RobotDog Market', 'Permit Market', 'Inventory', and 'Market Log'. The 'BUYER' section shows a permit icon, '0 / 2' permits, and '1' document icon. Below this, it lists 'costs per transaction' and 'personal nuisance' as  $-\$0.10$ . A large price of  $\$0.65$  is shown as the 'Permit Bid / Ask'. A slider is positioned at the  $\$0.65$  mark. At the bottom, there are buttons for 'Place Bid (Buy)', 'Place Ask (Sell)', 'Sell at Highest Bid' (circled in red), and 'Buy Lowest Ask'. The 'Recent Prices' section lists  $\$0.16$ ,  $\$0.15$ , and  $\$0.37$ . The 'BIDS' and 'ASKS' table shows the following data:

BIDS	ASKS
$\$0.00$	$\$1.54$
--	$\$1.64$
--	$\$2.05$

The bottom status bar shows '16' users, '00:45' time, and a home icon.

## Permit Market Screen

**Buy button**

This screenshot is identical to the one above, but with the 'Buy Lowest Ask' button circled in red. The 'Recent Prices' and 'BIDS'/'ASKS' table data are the same as in the previous image.

## Payoffs

Happy Playing!

### Your payoffs for the round:

- sum of payoffs from your RobotDog transactions
- **minus** nuisance cost from community RobotDogs
- **plus** price received for any permits you sell
- **minus** price paid for any permits you purchase